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Publications

## MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF APPLICATIONS BY EACH OF

(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A  
RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS  
CROWN LANDS WITHIN THE YUKON TERRITORY AND  
THE NORTHWEST TERRITORIES, and

(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY  
THAT MIGHT BE GRANTED ACROSS CROWN LANDS  
WITHIN THE NORTHWEST TERRITORIES,

FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

AND

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND  
ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION,  
OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE  
PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

November 13, 1975.

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## PROCEEDINGS AT INQUIRY

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Volume 86

CANADIAN ARCTIC  
GAS STUDY LTD.

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APPEARANCES:

Mr. Ian G. Scott, Q.C.,  
Mr. Stephen T. Goudge,  
Mr. Alick Ryder and  
Mr. Ian Roland for Mackenzie Valley Pipeline  
Inquiry;

Mr. Pierre Genest, Q.C.,  
Mr. Jack Marshall, and  
Mr. Darryl Carter for Canadian Arctic Gas  
Pipeline Limited;

Mr. Reginald Gibbs, Q.C. &  
Mr. Alan Hollingworth for Foothills Pipe Lines Ltd.;

Mr. Russell Anthony &  
Prof. Alastair Lucas for Canadian Arctic Resources  
Committee;

Mr. Glen W. Bell and  
Mr. Gerry Sutton for Northwest Territories  
Indian Brotherhood, and  
Metis Association of the  
Northwest Territories;

Mr. John Bayly or  
Miss Leslie Lane for Inuit Tapirisat of Canada,  
and The Committee for  
Original Peoples Entitle-  
ment;

Mr. Ron Veale and  
Mr. Allen Lueck for The Council for the Yukon  
Indians;

Mr. Carson H. Templeton, for Environment Protection  
Board;

Mr. David Reesor for Northwest Territories  
Association of Municipal-  
ities;

Mr. Murray Sigler for Northwest Territories  
Chamber of Commerce.

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Harlan, Hemstock, McCart  
Williams  
Cross-Exam by Scott  
Yellowknife, N.W.T.

November 13, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. SCOTT: Mr. Commissioner,  
I have one or two questions that I'd like to ask the  
panel before they leave, if I may.

R.L. HARLAN  
R.A. HEMSTOCK,  
PETER J. McCART  
GUY LESLIE WILLIAMS, resumed:

CROSS-EXAMINATION BY MR. SCOTT (CONTINUED):

Q First of all, Dr. Harlan,  
last night you told us that Dr. Hollingshead had indi-  
cated to you that it was presently proposed to design  
150 river crossings, or approximately 150 individual  
designs. I wonder if you can tell us, so we will have  
some sense of the scope of this response the number of  
crossings, the number of recognizable crossings that  
are not included in this 150, in other words how many  
others are there approximately?

WITNESS HARLAN: I'm not sure  
of the exact number. It strikes me that it's about  
1,000 crossings in total, so this would be about 25%  
of the crossings, and would include all the major streams  
and rivers.

Q Well, is that a thousand  
in the Northwest Territories?

A No, this would be on the  
total route.

Q Can you give us a ball  
park figure as to the number in the Northwest Territories?



Harlan, Hemstock, McCart  
Williams  
Cross-Exam by Scott

THE COMMISSIONER: Mr. Temple-  
ton, as I recall, said there were 600 crossings north  
of 60.

A That sounds about  
correct.

THE COMMISSIONER: That's what  
I mean, north of 60.

A Yes.

Q Do you think that's  
probably right?

A Yes.

MR. SCOTT: I missed that  
figure, Mr. Commissioner.

THE COMMISSIONER: Well, you  
can't catch everything, can you?

MR. SCOTT: Not when I'm  
talking, no. Does it bear repeating?

A Well, it's 600.

Q 600, thank you.

THE COMMISSIONER: You missed  
it both times around, when he said it and you said  
you were designing 250 crossings in Canada.

A In Canada, yes.

MR. SCOTT: Q 150 in the  
Territories and the Yukon.

A That is correct.

Q Well now, Mr. Hemstock,  
if the federal agency known as the Territorial Waters  
Board requested Arctic Gas or required Arctic Gas to  
make application with respect to any of the 150



Harlan, Hemstock, McCart  
Williams  
Cross-Exam by Scott

1 crossings that are going to be individually designed,  
2 what sort of -- in general terms, what sort of  
3 environmental information would you contemplate pro-  
4 viding in support of that application?

5 MR. MARSHALL: Well, Mr.  
6 Scott, this is a function of what's in the regulations  
7 and what's in the requirements of the Board. We're  
8 into hypothetical cases, I understand from our conver-  
9 sation last evening.

10 MR. SCOTT: Well, let me ask  
11 Mr. Hemstock this, Mr. Commissioner and I don't frankly  
12 find anything objectionable about a hypothetical case as  
13 this entire case is in its nature hypothetical at the  
14 moment; but if you were required to provide an  
15 environmental statement in support of an application  
16 to cross a specific river, we can take the one we were  
17 looking at yesterday, Black Creek or some other, what  
18 sort of material would you regard as being appropriate  
19 to provide a complete environmental statement relating  
20 to a river crossing?

21 WITNESS HEMSTOCK: Well, I  
22 think basically we would expect to provide the kind of  
23 information which is provided on the alignment sheets,  
24 and which would certainly indicate if there were any  
25 areas which were of concern. Now, if that type of infor-  
26 mation indicated something that was special with regard  
27 to that crossing, we would be able to handle that on a  
28 site specific basis.

29 Q And the information that  
30 is on the environmental sheets to which you refer is



Harlan, Hemstock, McCart  
Williams  
Cross-Exam by Scott

1 Dr. McCart's information as to fish populations and  
2 so on that he referred to last night.

3 A Yes, that would be the  
4 kind. From the other standpoint it might be the  
5 habitat which was in the river crossing area from let's  
6 say a mammal standpoint. If it were an area utilized  
7 by birds, that would be noted as it is on many of the  
8 alignment sheets.

9 Q What about the information  
10 that we discussed generally yesterday as to lowest  
11 winter waterflows, if you had that, the size of the zone  
12 of high permeability unfrozen material beneath the  
13 river bed, that sort of thing?

14 A I would regard that more  
15 as engineering data and as I said, it would be a  
16 site specific,-- on a site specific basis. If there were  
17 no fish downstream and Dr. McCart was not concerned  
18 with it, then that information would not be of any  
19 importance to the environmental side, but it might be  
20 from an engineering side.  
21  
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30



Harlan, Hemstock,  
McCart, Williams.  
Cross-Exam by Scott

1

2

Q

If it were of

3

concern to Dr. McCart, what sort of specific information  
4 would you contemplate with providing in those areas?

5

A

We probably

6

should have Dr. McCart answering it, but I would think

7

that he would want to have the information with regard

8

to minimum winter flows. Probably information on the

9

water quality, oxygen content. Certainly the status

10

of whether there was sub-surface flow or whether it was

11

above the bottom of the bed flow. I think that generally

12

would be the kind of information he would require in

13

order to determine the impact of the crossing on fish

14

populations downstream.

15

Q Do you want to add anything

16

to that Dr. McCart?

17

WITNESS MCCART: No, except

18

that I want to know the numbers of various species of

19

fish and their distribution with respect to the pipeline

20

crossing.

21

MR. SCOTT: Yes. Dr. McCart

22

I take it that in the event <sup>that</sup> there were critical

23

populations, if that was the phrase we ended up with

24

last night, and in the event that there was some

25

possibility of their being affected, you would want to

26

play some role in the location of the crossing itself

27

as opposed to its design or <sup>the</sup> construction techniques

28

by which it would be built.

29

A Yes, and we have made

30

comments on location in the past and there have been



Harlan, Hemstock,  
McCart, Williams,  
Cross-Exam by Scott

1  
2 changes as a result.

3 Q I take it that in the event  
4 that a water board wanted this kind of an environmental  
5 statement a fish biologist in a case in which there  
6 were fish populations that might be affected, would  
7 want to comment on location of the river crossings  
8 either pro or con.

9 A Yes, and we have already  
10 done this, I think, for most of the crossings where  
11 there, where we know there to be significant  
12 populations of fish.

13 Q Those are all the questions  
14 I have. I would like to thank the panel very much  
15 for their co-operation.

16 MR. MARSHALL: Before they  
17 step down, you had asked Mr. Williams for some infor-  
18 mation on some alternative borrow sites and he has  
19 checked that and can speak to that point now.

20 WITNESS WILLIAMS: Yes, I have  
21 discussed these two borrow sites with Miss Minning and  
22 she has instructed me to say that she hoped she hadn't  
23 left the impression that the application did not show  
24 that there were two borrow sites on the under plains,  
25 that she was referring to preferred sites. There are  
26 in fact two alternative sites shown on the under plains.  
27 One is at milepost 356.9.. It's borrow site number  
28 P291 on Oscar Creek. It is an alternative. The  
29 preferred site is P289. It is on an outwashed plain  
30 I think and she said that that has been investigated.



Harlan, Hemstock,  
McCart, Williams,  
Cross-Exam by Scott

1  
2 It is good gravel and certainly would be used unless  
3 some agency directed otherwise and of course the  
4 alternative to, the other alternative to the preferred  
5 site would be to go to the bedrock in the Franklin  
6 Mountains. The second site is at milepost 534. The  
7 borrow site in the meander plain again is P174. The  
8 alternative, I am sorry, the preferred site in that  
9 area is down closer to the Mackenzie. It is P170.  
10 That site has been investigated. The gravel is, there  
11 is some gravel there. It is not a good site so the  
12 probable procedure there would be to use the poorer  
13 material for the core of the pads and the road and the  
14 airstrip if there is one and rather than go to the  
15 meander plain there, go to an alternative bedrock  
16 source in the Franklin Mountains.

17 THE COMMISSIONER: All right.  
18 Well, thank you very much gentlemen and we'll see you  
19 again.

20  
21 (WITNESSES ASIDE)  
22  
23  
24  
25  
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27  
28  
29  
30



Bouckhout, Drew, Davison,  
Claridge, Vaartnou, Lawrence,  
Taylor, Reeves -- In Chief

1 MR. GIBBS: Can we start now,  
2 sir, with the Foothills panel? Could the panel please  
3 take their places then and those who have not been  
4 sworn be sworn? My preference for small panels, sir,  
5 seems to have been honoured in the breach while I  
6 have been away in a different form in a foreign place.  
7

8 L.W. BOUCKHOUT  
9 C.W. DREW  
10 FREDERIC B. CLARIDGE  
11 D. M. DAVISON, RESUMED;

12 DR. H. VAARTNOU  
13 N.A. LAWRENCE  
14 J.R. TAYLOR  
15 DR. B.O.K. REEVES, SWORN:

16 DIRECT EXAMINATION BY MR. GIBBS:

17 MR. GIBBS: Q Mr. Bouckhout,  
18 you are the Manager of Foothills' Environmental Affairs  
19 Department?  
20

21 MR. BOUCKHOUT: A Yes.

22 Q You have previously appeared  
23 before this Inquiry as a member of Foothills'  
24 location panel?  
25

26 A Yes.

27 Q What is the relationship of  
28 your position to other management and executive posi-  
29 tions in Foothills?  
30

31 A As Manager of Environ-  
32 mental Affairs, my position is parallel to those of  
33 the Manager of Construction and Manager of Engineering.  
34 I report directly to the Executive Vice President of  
35 Foothills.



Bouckhout, Drew, Davison,  
Claridge, Vaartnou, Lawrence,  
Taylor, Reeves -- In Chief

Q Would you please describe  
the makeup of Foothills' Environmental Affairs  
Department?

A Our department presently  
consists of three individuals, myself and two others.  
Mr. Bob Byers is a biologist who has had experience con-  
ducting aquatic studies in the Mackenzie Valley and  
in Alberta. In addition to his biological experience,  
Mr. Byers has worked on pipeline projects in Canada  
and the United States.

The third member of our  
team is Mr. Freeman Lamb. Mr. Lamb is also a gradu-  
ate biologist. In addition, he has worked on survey  
jobs and on dam and road construction. Mr. Lamb is an  
accomplished heavy equipment operator, having operated  
such machines as bulldozers, graders and earth movers,  
and has acted as job foreman on road construction.

I have described the back-  
grounds of the other two members of our department as  
their qualifications reflect my own attitude regarding  
the need to integrate biological and physical dis-  
ciplines for practical application to industrial  
projects.

Q Would now describe your  
approach to environmental impact with particular refer-  
ence to the physical environment?

A The Environmental Affairs  
Department is responsible for project input with regards  
to mitigation of environmental impact in the biological  
and physical realms. Since the welfare of the



Bouckhout, Drew, Davison,  
Claridge, Vaartnou, Lawrence,  
Taylor, Reeves -- In Chief

1 biological environment is dependent upon the integrity  
2 of the physical base, the two are inextricably inter-  
3 related. Thus, we view mitigation of impact on land,  
4 water and air as a goal of major importance.

5  
6 Local plant, fish, bird and  
7 mammal populations may be adversely affected by direct  
8 disturbance as a consequence of pipeline construction.  
9 If the physical base, that is the characteristics of  
10 the land, water and air which make up the physical  
11 habitats of living things, are not severely and  
12 irreversibly altered, plant and animal species will  
13 generally recolonize the affected areas.

14  
15 There will obviously be  
16 considerable change in the physical environment in the  
17 vicinity of project facilities including the right-of-  
18 way, compressor stations, access roads, stockpile sites  
19 and borrow areas. The nature and extent of change in  
20 the local characteristics of land, water and air can be  
21 predicted in most cases. In other cases impact will  
22 result from unanticipated or unpredictable events such  
23 as erosion or slope failures.

24  
25 Our approach to the  
26 physical environment is to spatially avoid potential  
27 problem areas where possible, to develop and implement  
28 mitigative measures in order to counteract potential  
29 adverse impacts, and to be prepared to recognize and  
30 react to unforeseen or unpredictable events which could  
have an adverse impact on the physical environment.

Q What is the mechanism for



Bouckhout, Drew, Davison,  
Claridge, Vaartnou, Lawrence,  
Taylor, Reeves -- In Chief

1 environmental input into the Foothills' project?

2  
3 A To appreciate the mech-  
4 anism of environmental input, one must recognize the  
5 ways in which mitigation of environmental impact  
6 can be accomplished. This can be done through  
7 influence in six basic areas:

8 First, the location of  
9 the pipeline and associated facilities can be influenced  
10 by site or area specific concerns. For instance,  
11 river crossing locations can be altered if the designa-  
12 ted location appears to be potentially unstable.

13 Second, physical design  
14 may reflect environmental concerns. The final selection  
15 of sewage disposal methods is influenced by an assess-  
16 ment of the potential affects of such disposal on local  
17 water quality.  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves - In Chief

1 Third,  
2 procedures such as clearing can be designed to minimize  
3 impact on terrain and on streams and rivers.

4 Fourth, the timing of project  
5 activities is an important factor in protecting the  
6 environment. Winter construction will, for instance,  
7 result in far less environmental degradation than  
8 would summer construction in most areas.

9 Fifth, contingency plans can  
10 be applied. For example, fire-fighting equipment and  
11 trained personnel will be available to cope with  
12 possible forest fires.

13 Sixth, restoration procedures  
14 such as revegetation and slope stabilization will be  
15 applied where necessary to restore the land to as stable  
16 and as natural a condition as possible.

17 Our Environmental Affairs  
18 Department retains several consultants whose responsi-  
19 bilities are to conduct appropriate studies and to  
20 advise the department on issues relative to the physical  
21 and biological environment. The other members of this  
22 panel represent some of those consulting firms.

23 Some of the same consultants  
24 also work directly for the Engineering Department. This  
25 is understandable since many of the issues which concern  
26 my department, with a view to minimizing physical  
27 alteration, also concern the Engineering Department in  
28 relation to maintaining the integrity of the pipeline.  
29 For instance, I would be concerned about cross-slope  
30 drainage from the point of view of avoiding major soil  
moisture regime changes upslope and downslope of the



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves - In Chief

1 the pipeline. Engineering personnel would be concerned  
2 about this factor in relation to the possible effects of  
3 upslope ponding and drainage across the line on the  
4 integrity of the filled trench and pipe.

5 Environmental Affairs person-  
6 nel co-ordinate the activities of our biological and  
7 physical consultants and channel their input to the  
8 Engineering Department. This is done through in-house  
9 discussion and meetings and in larger meetings at which  
10 the various consultants are present. Since the Foot-  
11 hills' staff is relatively small, most issues are  
12 confronted in frequent informal discussions rather than  
13 in formal meetings.

14 Our department will also  
15 prepare a Manual of Environmental Protection Measures  
16 which will be applied to all project phases. An  
17 inspection staff will be responsible for project surveil-  
18 lance with regard to the designated measures. In  
19 addition, an information program is being developed  
20 whereby environmental inspectors will become familiar  
21 with the design and construction methods and key  
22 engineering and construction personnel will be made  
23 aware of environmental concerns and applicable protec-  
24 tion measures. During the operation phase of the pipe-  
25 line, an inspector will be responsible for all  
26 environmental matters in each of the operation districts.

27 Q This panel has no one  
28 representing the topic of air quality. Would you ex-  
29 plain why?

30 A Our air quality consultant,



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves - In Chief

1 Western Research and Development Ltd., has indicated  
2 that impact on air quality during the construction and  
3 operation phases of the project should pose no serious  
4 problems. The topic of air quality was considered by  
5 our previous compressor station panel and we have  
6 nothing further to add at this time.

7 The other panel members will  
8 now describe more specific aspects of the Foothills'  
9 project relative to potential impact on the physical  
10 environment.

11 Q Before they do that,  
12 Mr. Boukhout, will you confirm that the Foothills'  
13 staff has also had access to the environmental material  
14 prepared by the Study Group prior to the withdrawal  
15 of Alberta Gas Trunk?

16 A That's right. Foothills  
17 has had access to all of this material, particularly  
18 through our relationship with the Alberta Gas Trunk  
19 Line. The Alberta Gas Trunk Line, of course, prior  
20 to its withdrawal from the Gas Arctic group, funded  
21 those particular studies and also in fact the Alberta  
22 Gas Trunk Line was the initiating company for the  
23 institution of the Environmental Protection Board.  
24 Therefore we do have access to all that information  
25 and we have in fact paid for a great deal of that  
26 information.

27 Q Mr. Drew, you are an  
28 associate of Sproule Associates Limited, a consultant  
29 to Foothills Pipe Lines Ltd.?

30 WITNESS DREW:  
Yes.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves - In Chief

1 Q You appeared previously  
2 before this Inquiry on behalf of Foothills?

3 A Yes, on the Local Panel  
4 of Phase 1 on August 21 and 22, 1975.

5 Q Have you amended the sheet  
6 describing your qualifications and experience?

7 A Yes, I have added two  
8 publications of mine and a forthcoming paper to make  
9 the sheet more appropriate to the physical environ-  
10 ment panel. Knowledge of climatology and meteorology,  
11 my avocations, is important in understanding the  
12 physical environment. The paper which I am writing  
13 now describes some of our Arctic land use research  
14 studies mentioned in the first part of my answer to the  
15 next question.

16 Q Do you, as a professional  
17 geologist, wish to expand upon your qualifications to  
18 make them more applicable to physical environmental  
19 matters?

20 A Yes, I do. The largest  
21 project which I have been working on and supervising  
22 during the past three years has been the preparation  
23 of terrain sensitivity photomosaics, accompanied by  
24 land use classification charts, of the Canadian Arctic  
25 Islands for the Arctic land use research program of the  
26 Department of Indian Affairs & Northern Development,  
27 Government of Canada. In addition, I have conducted  
28 environmental photogeological and field studies of the  
29 surficial geology and physiographic features of Yoho  
30 National Park, British Columbia, and Dinosaur Provincial



Bouckhout, Drew, Claridge,  
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Taylor, Reeves - In Chief

1 Park, Alberta, for the Federal and Provincial Govern-  
2 ments, respectively.

3 In addition to my professional  
4 interests and capabilities, my avocational interests  
5 of hiking, back-packing, cross-country skiing, and the  
6 outdoors in general give me a strong feeling for the  
7 land and understanding of it and its sensitivity.

8 Q Why did you, unlike  
9 Arctic Gas Pipeline, add terrain sensitivity to your  
10 terrain typing?

11 A We are concerned with the  
12 physical environmental impact of access and ancillary  
13 facilities as well as the pipeline itself and want to  
14 assess the sensitivity of the terrain units of the  
15 whole corridor since they provide the foundation of  
16 the physical environment.

17 The terrain sensitivity is one  
18 of the major factors in determining the environmental  
19 concern for construction, operation and abandonment of  
20 a gas pipeline.

21 The impact upon the physical  
22 environment of pipeline construction and related  
23 activities will bear a relationship to the terrain  
24 sensitivity and also depend upon the methods used for  
25 construction and access. The sensitivity ratings on  
26 the alignment sheets could be useful for planning any  
27 summer service access for such contingencies as  
28 emergency repairs. Terrain sensitivity mapping,  
29 then, assists in planning for a minimum impact of  
30 construction and related activities, as well as



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves - In Chief

1 subsequent operation and finally abandonment of a gas  
2 pipeline.  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
In Chief.

Q What type of terrain sensitivity did you indicate?

A I indicated terrain sensitivity from a physical environmental point of view. Terrain sensitivity can be defined as the susceptibility of the ground to damage, or alteration from the natural state as a result of external activity. The external activity can either be man's activity of trespassing upon, excavating from the terrain, etc., or natural activity such as stream erosion, which can result indirectly from man's activities of disturbing upstream areas or removing vegetation.

This is in contrast to the engineering and construction versions of terrain suitability, which deal with the engineering characteristics of the unit.

Take the terrain type 'TS', talus slopes, as an example. From an engineering or construction point of view, talus slopes are considered to be a problem because of their loss of strength and settlement when thawed and their potential for frost heaving. I consider these properties more of engineering suitability than terrain sensitivity. From an environmental point of view, I have given talus slopes our lowest terrain sensitivity rating of '1'. If man crosses a talus slope or digs a trench across it, individual rocks and other particles will move down-slope and tend to fill in the scar. Even when many



Bouckhout, Drew, Claridge,  
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In Chief.

1  
2 rocks are displaced downslope, it is not a change from  
3 the natural state of the unit, which is still a steep  
4 slope of loose rocks and other particles; therefore,  
5 the low terrain sensitivity rating.

6 Q What is the relationship  
7 of terrain sensitivity to physical environmental  
8 impact?

9 A The higher the terrain  
10 sensitivity, the greater, in general, is the  
11 potential physical environmental impact resulting from  
12 human activities. Of course, the physical environ-  
13 mental impact upon a given piece of terrain depends  
14 upon its vegetation as well as upon the terrain  
15 sensitivity of the surficial geological unit itself.  
16 Usually, a given surficial geological unit or terrain type  
17 and its derived soil will support a certain community of  
18 vegetation within a physiographic division or at least  
19 a local area. Where vegetation types vary upon a given  
20 terrain type as a result of such things as forest fires,  
21 that vegetation, or lack of it should be taken into  
22 account along with the terrain sensitivity rating in  
23 considering potential for physical environmental impact.  
24 In assessing the terrain sensitivity ratings, the general  
25 vegetation type on the unit at the time of photography  
26 was taken into consideration. In refining the terrain  
27 sensitivity ratings by on-site inspection, the types  
28 and amount of vegetation at the time of field checking  
29 are taken into consideration since vegetation reflects  
30 underlying terrain characteristics.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
In Chief.

Q Now that you have done field checking on the laterals to Yellowknife and Pine Point, what is your general impression of those routes from a physical environmental point of view?

A In general, the lateral routes to Yellowknife and Pine Point, which leave the mainline route near the Redknife Hills and diverge near Fort Providence, exhibit less terrain sensitivity than the mainline corridor, especially its northern parts. There is much less evidence of ground-ice on the lateral routes to the Great Slave Lake area. There is some incipient beaded drainage but very little other evidence of ground-ice was seen. Fairly well drained and dry, sandy lacustrine deposits are widespread, especially from Fort Providence junction to Rae-Edzo. With nearly flat terrain, the sensitivity of this sandy subsoil is generally low to moderate unless vegetation is removed to allow the sand to blow. Bogs with higher terrain sensitivity are more widespread from the Fort Providence Junction to Pine Point, but even there, the underlying terrain type is commonly a sandy and gravelly mixture of several terrain types, especially near Pine Point, and again relief is very low.

From Rae-Edzo to Yellowknife in the Bear-Slave Upland Physiographic Province, the route traverses the Canadian Shield with insensitive granitic bedrock being predominant. The associated



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1  
2  
3 lacustrine deposits, though often fine grained, have  
4 much less peat than indicated on our initial mapping.  
5 In places, they are sandy and sometimes, especially near  
6 Yellowknife, grade into gravelly outwash. The bedrock  
7 in the Great Slave Plain portion of the Yellowknife and  
8 Pine Point laterals is predominantly limestone and sand-  
9 stone, again with low terrain sensitivity, although  
10 somewhat more sensitive gypsum is exposed in highway  
11 cuts and borrow pits south of Rae-Echo.

12 In conclusion, It is evident,  
13 at this stage, that due to the abundance of sand, gravel,  
14 or hard bedrock with less water, ground-ice and  
15 topographic relief than is general for the mainline  
16 corridor, the average terrain sensitivity along the  
17 lateral corridors to Yellowknife and Pine Point is  
18 lower. Consequently, the construction and operation  
19 of pipelines to service the communities around the  
20 western half of the Great Slave Lake would have less  
21 physical impact upon the environment. Our terrain  
22 typing and description shown on the alignment sheets  
23 is being revised on the basis of the field evidence  
24 to depict more accurately the conditions to be expected  
25 en route to these Great Slave Lake communities.

26 Q Mr. Drew, from your  
27 knowledge of Foothills' lateral routes to Yellowknife  
28 and Pine Point, and having seen the Arctic Coastal Plain  
29 traversed by the Arctic Gas route from the Alaska border  
30 to and alongside the Mackenzie Delta, what is your  
impression of the relative terrain sensitivities of



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these two proposed pipeline areas?

A In the fall of 1969, I made a reconnaissance study on the airphotos and on the ground of the proposed Mackenzie Valley Pipeline prime and alternate routes across the Arctic Coastal Plain from the Alaska border to and alongside the Mackenzie Delta. There is much more ground-ice in that coastal plain and alongside the Mackenzie Delta than along the routes to Yellowknife and Pine Point. I feel reasonably confident that there is at least as much and probably more fine material (silt and finer) in and near the coastal plain as there is along the Foothills' lateral routes in the western Great Slave Lake area. The Canadian Arctic Gas alignment sheets show that the major portion of their corridor from the Alaska border to the Mackenzie Delta and, to a lesser extent, alongside the Mackenzie Delta have silty surficial deposits at least a yard thick.

A combination of high ground-ice content and fine grained material obviously gives CAGPL's Alaska to Mackenzie Delta route and overall terrain sensitivity considerably greater than that along Foothills' routes to Yellowknife and Pine Point.



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Q Mr. Davison, you are a  
director of Klohn Leonoff Consultants Ltd., a consultant to Foothills Pipe Lines?

WITNESS DAVISON: Yes.

Q You have appeared  
before this Inquiry as a member of the geotechnical panel during the engineering phase?

A Yes.

Q Do you wish to either  
add to or amplify any of your previously given experience qualifications?

A Yes, the experience  
which I believe is particularly relevant to this panel concerned two environmental impact studies in which I was personally involved. The studies are the Richards Island and Parsons Lake gas gathering systems and the Pointed Mountain Gas Pipeline.

Q What was your involvement  
on those studies?

A We were employed by F.F. Slaney & Company of Vancouver for both studies. Their client was a consortium of four companies for the Richards Island and Parsons Lake study, and DIAND for the Pointed Mountain study. Our input to these studies was to assess the impact of the proposed development on the physical environment while Slaney & Company addressed themselves to all other aspects of the environment.

We carried out overviews for  
both projects. The Richards Island-Parsons Lake study



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1 was more comprehensive than the Pointed Mountain study  
2 in that the latter was an assessment of the impact of  
3 the pipeline alone while the former was an assessment  
4 of the impact of gas processing plants as well as the  
5 pipelines.

6 Q What do you mean, Mr.  
7 Davison, by "overview"?

8 A Essentially it is a  
9 broad review. We work with general information rather  
10 than site-specific information. For the two studies  
11 mentioned, we reviewed topographic and geologic plans,  
12 and air photos as well as any reports or technical  
13 papers previously prepared on the study area. After the  
14 office study, a site reconnaissance was done to spot  
15 check the soil, ground ice, and topography as well as  
16 to review the drainage and existing slope stability.  
17 Due to the short time period available to carry out  
18 the reconnaissance, we were only able to look at the  
19 ground exposures and conditions at one time of the year.

20 Q How were these assessments  
21 done?

22 A We described the general  
23 topography in the study area and the anticipated soil  
24 and permafrost conditions as well as existing slope  
25 instability and drainage patterns. The descriptions  
26 set the conditions upon which the development would  
27 either affect the physical environment or be affected  
28 by the environment. Using the setting, we then indicated  
29 the areas of major concern.

30 Q In studying these projects



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1 what did you find were the major areas of concern?

2 A The major areas of  
3 concern were drainage disruption, erosion and slope  
4 stability, These are general problems which apply to  
5 any development passing through long segments of topo-  
6 graphy.

7 Q How do these concerns relate  
8 to the proposed Foothills' Pipe Line project?

9 A The Foothills Pipe Line  
10 will pass through both the continuous and discontinuous  
11 permafrost zones as well as a variety of topographic  
12 and subsoil conditions.

13 As the Foothills' pipeline  
14 starts on Richards Island, with a lateral to Parsons  
15 Lake, the conditions and concerns for the Foothills'  
16 pipeline are the same as for the Richards Island and  
17 Parsons' Lake gathering system. The Pointed Mountain  
18 Pipeline, which is located within the southern limit  
19 of the discontinuous permafrost, has similar topographic  
20 conditions to southern sections of the Foothills'  
21 pipeline and hence concerns are similar.

22 Q Would you please explain  
23 what you mean by "drainage disruption"?

24 A Drainage disruption is  
25 either a barrier or depression which interrupts the  
26 natural preferred direction of flow of drainage.

27 Q What is your basic approach  
28 to the drainage disruption problem?

29 A We feel that identification  
30 of the drainage paths which will be interfered with by the



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1 development is one of the most important aspects of  
2 setting up the problem. One of the first principles of  
3 geotechnical engineering is to allow water to flow  
4 in its preferred direction. When you force water to  
5 flow in another direction, it can result in either  
6 ponding or increased erosion. You can have the best  
7 designs to minimize the obstruction, but when the  
8 designs are not used at the location of the present  
9 drainage path, the designs may not be effective. Mr.  
10 Claridge will discuss this problem further, as it  
11 applies to the Foothills' pipeline.

12 Q What is your basic  
13 approach to slope stability problems?

14 A Our basic approach is  
15 to minimize the problem by selecting the shallowest  
16 stable slope. Where a river crossing is concerned,  
17 we will also attempt to select a straight section of  
18 the river with, ideally, a flood plain on either side.  
19 The data required for design of the slope is then  
20 dependent upon how many of these route location para-  
21 meters can be met. In general, our approach is to  
22 minimize the problem where possible through route  
23 location. Mr. Claridge will discuss further the  
24 factors involved in assessment of the slopes.

25 Mr. Claridge, you are an  
26 executive engineer with Klohn Leonoff Consultants Ltd.?

27 WITNESS CLARIDGE: Yes.

28 Q You have previously  
29 presented testimony to this Commission on September  
30 18, 1975. Do you have anything further to add to your



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1 description of academic qualifications and experience  
2 which you presented at that time?

3 A Yes sir, I would like  
4 to refer to a paper which I co-authored in 1974  
5 describing studies of the impact of a proposed  
6 hydro reservoir. This reservoir is to be contained  
7 between banks of sensitive marine clay in Eastern  
8 Ontario. The paper dealt with aspects of erosion, ground  
9 water conditions, and slope stability, each of these  
10 in relation to the environmental consequences of impound-  
11 ment. The studies may have a particular relevance  
12 to environmental concerns for a northern pipeline  
13 because of the similarity in certain aspects. These  
14 include the regional character of the hydro project, the  
15 expressed concerns of the communities and land-owners  
16 surrounding the reservoir, and the similarity in sensi-  
17 tivity and reaction to disturbance of marine clay to  
18 many types of permafrost soils.

19 Q Would you please describe  
20 field studies in which you are involved for Foothills  
21 Pipe Lines Ltd. that contribute to our understanding  
22 of the physical environment?  
23  
24  
25  
26  
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28  
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30



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1 A Field studies on the pro-  
2 ject commenced in January, 1975 with a 2-1/2 week long  
3 reconnaissance inspection of the route and examination  
4 of major river valleys. The studies continued with a  
5 drilling program instituted within a hundred mile por-  
6 tion of the pipeline south of Fort Simpson during Feb-  
7 ruary and March 1975. A program of reconnaissance  
8 observations and test drilling has been carried out  
9 through the summer, beginning on May 27, 1975.

10 Slopes have been mapped  
11 and measured both along the pipeline and in adjacent  
12 areas. The purpose of the measurements is to provide  
13 comparative data with which to assess slopes at the pro-  
14 posed pipeline route, particularly major slopes at  
15 river crossings.

16 The data are also used to  
17 select alternative routes where slopes crossed by the  
18 pipeline may be less severe. Drainage studies have  
19 also been conducted in representative terrains at various  
20 locations along the pipeline route. These studies  
21 provide base data which will be used in defining  
22 existing drainage conditions and which will provide the  
23 basis for developing design methods.

24 A drilling program has also  
25 been instituted to determine soil conditions at the  
26 locations of critical slopes at river crossings as well  
27 as within the drainage study areas.

28 Q In previous testimony for  
29 the Geotechnical Panel, you described retrogressive  
30 or retreating thaw slides as being a prominent feature



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1 along the pipeline route. Can you comment on the  
2 impact of this type of slide?

3  
4 A Retrogressive landslides  
5 are the most severe form of slide along the study area.  
6 Retrogressive landslides are almost always initiated by  
7 erosion, frequently along a bend in a river where steep  
8 slopes may have formed.

9 In combination with ice-  
10 rich fine grained soils, a retrogressive type of  
11 slide may occur. Our principle concern is therefore  
12 to recognize the conditions where this type of slide  
13 may occur and to avoid such slopes and especially loca-  
14 tions where there is a potential for erosion. For  
15 example, we attempt to route the pipeline where  
16 possible within straight reaches of the river where  
17 erosion is usually minor.

18 Major landsliding can be  
19 prevented by countering the erosion process once it is  
20 recognized. Hence, an important aspect of slope  
21 stability assessment is that the pipeline route be  
22 inspected at regular intervals during the first few  
23 years of operation. Application of granular riprap  
24 would be a primary treatment used in controlling  
25 erosion. Procedures would be developed for use during  
26 and after construction to ensure that suitable measures  
27 are implemented at an early stage in the erosion process  
28 to prevent the occurrence of a retrogressive landslide  
29 within the pipeline right-of-way.

30 Q Would you please describe



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1 in more detail the drainage studies which you are con-  
2 ducting and how they will be used in providing environ-  
3 mental protection?

4 A We feel that drainage must  
5 be studied primarily in the field, as drainage and  
6 erosion characteristics are controlled by a variety of  
7 factors, most notably topography and soil conditions,  
8 which cannot be adequately assessed from a review  
9 either of maps or of aerial photographs. The data  
10 which we feel are essential to an understanding of  
11 drainage, both as it presently exists and as it will  
12 be affected by the pipeline, are as follows:

- 13 1. Depth of unfrozen  
14 surface layer from season to season.
- 15 2. Location, dimensions  
16 and estimated flows within active flow channels.
- 17 3. Location and dimensions  
18 of seasonal flow courses.
- 19 4. Slope gradients on a  
20 local topographic scale.
- 21 5. Permeability or  
22 hydraulic conductivity measurements in surficial  
23 unfrozen soils.

24 Preliminary results from  
25 our spring reconnaissance of two study areas were  
26 presented to the Commission on August 19, 1975. Today  
27 I will make a brief presentation of the drainage  
28 conditions within two of the study areas. I will show  
29 some slides. I will make a correction.. That was  
30



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1 September 19 rather than August.

2  
3 This is one of the study  
4 areas located at Mile .536.9 between the Whitesand River  
5 and the Ochre River.

6 Q With the other hand you  
7 can handle the pointer.

8 A If only I had one more hand. This area is located at  
9 Mileage .536.9. To the north of this is the Whitesand  
10 River. To the south is the Ochre River.

11 The pipeline follows very  
12 approximately where the seismic line has already been  
13 cleared. The study area was within approximately this  
14 area. It is roughly 4,000 feet long and about 1,000  
15 feet across the pipeline.

16 The terrain is typed as  
17 a ritual lake basin. Number 1 -- it is basically a  
18 clay deposit. The drainage source is in a ridge of  
19 low hills located here essentially we're looking at  
20 cross flows through drainages that I am indicating in  
21 very rough terms here. It enters a creek which drains  
22 from the small lake into that lake.

23 Here is an example of a  
24 close-up view of one of the minor streams. It is a  
25 stream that has carried water throughout the summer.  
26 You note that <sup>it</sup> is barely visible on this photograph.  
27 It was carrying a depth of water about 6 inches, about  
28 a foot width with a flow of about 1/2 foot per second.  
29 It is very minor and it is something that I think one  
30 of the conclusions we arrived at was it is rather



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1 difficult to pick up even the drainages with distinct  
2 flow and almost impossible to pick up the ones without  
3 flow without a ground type reconnaissance such as this.  
4 This is one of our purposes in reviewing on-site  
5 conditions.  
6

7 Here is an example of  
8 the organic mat which covers practically all of the  
9 drainage areas we studied. Incidentally we did study  
10 eight of them in total in a variety of topographic and  
11 terrain conditions. This small excavation is to a  
12 depth of five inches at which the permafrost table was  
13 encountered. This was in early June so it's rather  
14 shallow. By the end of the summer, it had regressed  
15 by about another foot in this location.

16 You will note there is a  
17 small reflection/<sup>here</sup>indicating water and the mechanism of  
18 ground water flow at this point is flow right along the  
19 top of the ice. The peat itself is moist and the flow  
20 is within perhaps two or three inches directly above  
21 the ice. As part of our study we installed geo-nor  
22 type piezometers~~within~~ the peat layer and conducted  
23 insitu tests to determine the conductivity of the  
24 material and through measurements of slopes we were  
25 able to arrive at an estimate of the active layer flow.

26 We concluded that most  
27 of the flow at this time of the year occurred in this  
28 peat. Later on in the season as the frost level  
29 regressed, the peat dried up and the flow tended to  
30 drop down into the mineral soils beneath.



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1  
2 This is another seasonal  
3 drainage course. It is about 8 feet wide just running  
4 through approximately like that. You see little strings  
5 of standing water. There is no evidence of flowing  
6 water but there is a depression. You can't see it on  
7 the photograph. You have to see it in three dimensions.  
8 The depression is very minor but it is continuous rather  
9 sinuous but continuous and we feel this would be a  
10 major conductor of water immediately after snow melts.  
11 That is the type of drainage that we feel is very  
12 important to account for in designing mound breaks,  
13 that it will carry a good deal of water early in the  
14 year. Later in the year it probably is going to dry  
15 up.

16 This is another example  
17 of a low-lying area. It's actually about 80 feet wide  
18 at this area. That would become wet and would serve as a  
19 seasonal drainage course. There are tiny meandering  
20 depressions through this which would carry water and  
21 again in the final design stage we would have to assure  
22 ourselves that we <sup>had</sup> picked up each of the low areas and  
23 this is one that the probe is stuck into and following  
24 back like this and install a mound break.

25 This is a representation  
26 of the results of that particular study area. Just for  
27 the record, the mileage indicated on the slide is  
28 incorrect. It shouldn't read 536.9.  
29  
30



The upper diagram diagram

The number of courses on this particular plot, I believe it's a total of 10 over a distance of about 4,000 feet, so anyone who is interested in averages, that would work out to a drainage course every 400 feet.

This is the same study area on the lower part of the slide. It's a representation of <sup>the</sup> topography with high ground marked and low ground marked with the separations shown by the dashed lines. The traverse lines that were followed are indicated



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1 on these lines and slopes were measured using an  
2 inclinometer, both parallel to the pipeline and trans-  
3 verse to the pipeline. Now the typical topography. In  
4 this section slopes range from about 1% up to a  
5 maximum of 8%. Here is a maximum point. This location,  
6 if we had gone further up the flank of the hill we  
7 would have found that percentage increasing to about  
8 15 or 20%.

9 Now, these slopes are important,  
10 both from a hydrologic prediction point of view and  
11 to estimate the active layer of flows and what we have  
12 done in the upper diagram is take the piezometer  
13 results and they were obtained right in the middle of  
14 the area here and we have calculated the flow through  
15 the active layer that time of year. It's plotted  
16 against a scale on the left, which is exaggerated by  
17 100 times compared to the other line here, which  
18 represents the combined surface runoff based on a  
19 50-year storm. In other words, the maximum runoff  
20 during a 50-year period.

21 Now, if you reduce this active  
22 layer of flow by a factor of 100, you would visualize  
23 it being a very small proportion of the combined sur-  
24 face runoff that would occur in a 50-year period.  
25 Beneath the middle line here, the vertical lines  
26 represent on one scale the maximum anticipated flow  
27 through a pipeline break; and for this example it's  
28 in the order of five cubic feet per second and on the  
29 left is the corresponding velocity through that break,  
30 and these range from about .3 feet per second up to a



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1 maximum of a little over one foot per second. What we  
2 are proposing in our design is to relate the allowable  
3 of flow velocities through the breaks to the type of soil  
4 which underlies it. and where the velocities exceed  
5 what we would term a threshold criterion for a soil  
6 type, then we would protect it through use of granular  
7 or other types of protective material and then we'll  
8 give an example of that in the next slide.

9 Where protection is required,  
10 this is a schematic view as to how it would look. In  
11 plan the pipe runs left to right. We are assuming  
12 that we have a slope parallelling the pipeline. Thus  
13 we have put in a small guide fill / of sand and gravel which  
14 serves to deflect the flow into the berm. In addition  
15 we would expect the cross-flow running from the bottom  
16 to the top of the slide. The sand and gravel would  
17 be set in terms of gradation by the velocity criterion  
18 that I referred to. In longitudinal section, if we  
19 took a section AA, like so, here is the sand and gravel  
20 protecting the ditch. There would be sandbags treated  
21 with cement to protect the pipe mound from erosion,  
22 and that protection would extend for, we've shown, eight  
23 feet beyond the edge of the break.

24 In the case of an ice-rich  
25 soil, where we felt that there was a concern for thawing  
26 and depression, we would perhaps place insulation as  
27 shown, directly beneath the gravel. Another cross-  
28 section BB, which runs like so on plan indicates the  
29 insulation and the overlying gravel, and if it were in  
30 ice-rich soil, we're indicating that a dry granular



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1 backfill would have to be placed to avoid the possibility  
2 of thaw settlement.

3 This is the second study area  
4 that I'm referring to today. It's at Mileage .3 11.3,  
5 it's just to the north of Chick Lake, which you see  
6 here. The pipeline roughly parallels the Canadian  
7 National Telegraph -- Telecommunications line which  
8 runs like so. North is that direction, to the right.  
9 This is a very distinct cross-drainage pattern. You  
10 can see the drainage courses as the dark streaks. It's  
11 in a glacial lake basin, lacustrine condition again  
12 with a thin cover of slope wash. The dimensions of the  
13 area run from here to about here. Again it's about  
14 3,000 feet long and about 1,000 feet across.

15 Again, we have plotted the  
16 active and seasonal drainage courses. You may be able  
17 to see some of the solid lines that are active flows,  
18 the dashed lines are inactive. In spite of the  
19 very prominent looking drainage, we found that there  
20 were actually fewer crossings in this stretch than there  
21 were in the previous area studied and this may reflect  
22 the fact that there are slightly greater slopes and  
23 the drainage is more concentrated and as a result there  
24 are fewer drainages necessary to conduct the flow.  
25 Permafrost depths again are shown beneath a quarry with  
26 the figures, but we found that the depths were  
27 slightly greater than at the previous location, in spite  
28 of the more northerly latitude and this probably  
29 reflects the presence of slightly disturbed moss and  
30 the absence of trees due to a fire which had occurred



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1 a number of years previously, and the moss had been  
2 charred in a few places and we feel this has detracted  
3 slightly from the insulation characteristics of the cover.

4 Again the plot of slopes and  
5 the slopes were taken across the pipeline and along the  
6 pipeline and on this diagram range up to oh, about  
7 four or 5% total. The break design, as in the previous  
8 presentation and an estimate of combinēd surface runoff  
9 and active layer of flow shown below.

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4 Here is just an example of  
5 what happens in a situation where drainage is not  
6 controlled. This is a slide from mileage point 430 on  
7 the pipeline, mileage 430 on the pipeline, but it is on  
8 the CNT line just a mile or so away from the proposed  
9 pipeline route. There is a very, very minor source  
10 of water just below to the right of this slide and it  
11 has not been controlled to cross the right-of-way and  
12 there is a 14% slope down into a river, a very small  
13 stream actually, it passes through at this point, and  
14 because of the cross-slope the small drainage has been  
15 captured. It is a thin layer of clay which has been  
16 undercut by the run-off and beneath the clay is fine  
17 cohesion sand and that has eroded out with fairly  
18 dramatic results. I might point out that this type  
19 of situation actually is quite rare along the CNT line  
20 and I think the point I would like to make is that at  
21 the time the CNT line was put in, there was apparently  
22 not a great deal of attention put to trying to prevent  
23 disturbance of the surficial layer and to put in  
24 adequate cross-drainage and my own feeling is that it's  
25 reassuring to see that there are actually very few  
26 examples of this type of erosion, when you consider that  
27 there was not a great deal of protection provided for  
28 the right-of-way.

29 An example of the thaw slide,  
30 a retrogressive type of failure, in every case in our



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1  
2  
3 study we noted that either a river or a lake was  
4 responsible for the initiation of the slide, that in  
5 some cases they would be immature in developing.  
6 There actually is a line at about that point and about  
7 that point where this slide is extending and beginning  
8 to be initiated by tow erosion from this lake and  
9 you can see the dramatic effects that it can have.

10 THE COMMISSIONER: And that, Mr. Claridge, is  
11 a natural cause?

12 A This is a natural cause.  
13 I think the point again that we have tried to stress  
14 is that slides of this nature just do not occur without  
15 a cause. That they occur on steep slopes. There is  
16 always a source of erosion at the tow . They begin  
17 very innocently but they are predictable, they are  
18 understood, they do occur on relatively steep slopes  
19 which when one recognizes what the general conditions  
20 are, where a slide will be initiated, one can then go  
21 and find a location where this type of slide is very  
22 unlikely and if the process leading up to a development  
23 of this type of slide is recognized, it can be counter-  
24 acted through the use of riprap.

25 That completes my answer to  
26 question five, Mr. Gibbs.

27 Q Mr. Claridge, how will  
28 sheet flow be affected by the drainage provisions you  
29 have just described?

30 A Well field studies have



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2  
3 shown that sheet flow as it is known, is in reality  
4 a combination of poorly defined but distinct surface  
5 drainage channels and active layer flow. We have  
6 determined that the method of treatment of defined  
7 drainage courses will apply equally well to the surface  
8 portion of the sheet flow. Further, that portion of  
9 flow occurring in the active layer has been determined  
10 to be a small proportion of the total flow occurring  
11 during run off period and also in respect to the total  
12 amount of drainage which is affected by the pipeline.

13 Q How do you propose to  
14 control erosion in the short term immediately following  
15 construction?

16 A Our efforts to date have  
17 been focused on three areas of concern. They are:  
18 1) protection of the right-of-way and any adjacent  
19 or disturbed terrain where concentrated flow will  
20 exist.  
21 2) location and dimension of mound breaks where flows  
22 will be concentrated.  
23 3) the effects of dispersed or concentrated flow along  
24 highly disturbed ground such as adjacent to the  
25 pipeline mound or on the surface of cut slopes or  
26 fills.

27 . The pipeline mound and adjacent  
28 disturbed ground, if left unprotected, will be highly  
29 susceptible to erosion. This is especially so where  
30 the pipeline descends slope.



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The vegetation procedures described by Dr. Vaartnou, will provide long term protection. However, short term control, particularly during the first summer, following grading and pipeline installation will require additional treatment. The type of treatment employed will depend on the degree of the disturbance of the terrain, the potential for concentrated flow and the particular soil base conditions which pertain.

Among the temporary erosion control materials which will be utilized in areas of potential erosion are the following:

- 1) available protective cover, such as, brush, logs, and wood chips.
- 2) granular protection which would be covered by a layer of topsoil, which in turn would be covered by shredded organic material.
- 3) Manufactured mulches, such as wood fibre, straw, or excelsior blanket.
- 4) protective nettings. Nets would consist of jute where a maximum protection is required or perhaps substitutes such as paper or other biodegradable substitutes. Nets would be applied either in conjunction with mulches or otherwise on their own. Nettings would be applied principally in swells and immediately adjacent to the pipeline mound where concentrated flows may occur and the base soil is highly erodible as in ice-rich fine grain soils.



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Q What measures do you  
propose to prevent siltation of streams, particularly  
those which contain important fish populations?

A This question may be  
answered in two parts. The first part dealing with  
silt originating through bank and slope erosion. The  
second part treats siltation which arises from trenching  
the stream bed during construction.

If the surface treatments  
of mulches, netting and revegetation are fully effective  
on the slope approaches, moving water will not have  
an opportunity to take up silt and further measures  
to protect against siltation will not be necessary.

However, additional precautions  
are warranted on steep slopes where flow velocities  
may exceed threshold values and especially where highly  
erodible soils exist in proximity to a fish stream.

The type of precautions would  
depend on the site specific conditions. Among the  
protective devices which are being considered are the  
following:

- 1) breakers placed along the right-of-way, sorry across  
the right-of-way, or disturbed zone adjacent to the  
pipeline mound to reduce the velocities or to  
disperse concentrated flows where the pipeline  
decends a slope.
- 2) checks installed, as above, except within drainage  
ditches where they are permitted in unfrozen or



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thaw-stable soils.

- 3) diversion berms to divert cross-flows to adjacent drainage courses. These would be especially applicable where flow would otherwise pass on to a cut slope.
- 4) siltation basins may be provided at the toes of steep slopes to trap silt and prevent it from entering streams. These would be especially useful where severe longitudinal drainage follows a pipeline right-of-way.
- 5) granular protection including the application of light riprap within the right-of-way at minor stream crossings. Major streams and rivers would be given individual design study and I might add a good number of the minor streams as well.
- 6) granular backfill of the pipeline trench where highly erodible soils are encountered and where the degree of slope exceeds the threshold value permitting erosion of soil. With respect to possible siltation arising from trenching operations in streams and rivers, our approach is to return the stream bed as much as possible to its original state. Most of the stream and riverbeds crossed by the pipeline have a cover of granular soil. Construction activity would be directed at returning the same or equivalent imported soil to the bed so that any underlying fine grained materials are protected against scouring. Construction of river



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1  
2  
3 and stream crossings will generally be done during  
4 the winter when the potential effects on fish will  
5 be minimal in most cases. If situations develop  
6 where construction proceeds at another time of the  
7 year or if the fish would be severely affected by  
8 the trenching and backfilling activities, temporary  
9 diversion would considered. Stream diversion would  
10 be made by means of a culvert or an excavated  
11 by-pass channel.

12 Q Please describe the procedure  
13 which you would follow in final design for control of  
14 drainage and for erosion protection?

15 A The first element of final  
16 design would be to locate all seasonal and active  
17 drainage courses using arial photographs and confirming  
18 and adding to the identification during the walk-over  
19 survey.

20 Local soil and ice conditions  
21 will be determined and a final stage of probing and  
22 surficial protection would be designated according to  
23 the results.

24 A design change manual would  
25 also be developed to describe the basis for selecting  
26 erosion control methods and to provide the logic on  
27 which an inspector may prescribe alterations during  
28 construction where conditions are found to be different  
29 from those assumed in the design.

30 Hydrologic assessment of surface



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run-off will be made along the entire pipeline route  
on a mile by mile basis during final design. The  
assessment will be based on analysis of precipitation  
data and the interpretation of aerial photographs and  
topographic maps/<sup>from</sup> which the main drainage courses  
and size and slopes of catchment areas can be determined.



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1 We recognize that the selec-  
2 tion of erosion prevention procedures are in a state  
3 of development and we acknowledge that further study  
4 will be required to demonstrate the effectiveness of  
5 the various procedures. Therefore, test areas are  
6 proposed which would be monitored throughout construction  
7 to assist in confirming the most appropriate procedures.  
8 We also acknowledge the desirability of assessing the  
9 effectiveness of the revegetation and protective  
10 measures which have been instituted on the Trans-Alaska  
11 Pipeline. We anticipate that, by the time erosion  
12 control is to be instituted on the Mackenzie Valley  
13 Pipeline, sufficient time will have elapsed to permit  
14 a proper evaluation of the methods used in Alaska.

15 THE COMMISSIONER: Excuse me.  
16 Dr. Claridge, how much time will have to elapse from  
17 now to permit a proper evaluation of the methods used  
18 in Alaska in relation to drainage and erosion control?

19 A We are already looking  
20 at an inspection tour in Alaska next spring, either  
21 late spring or early summer. There will have been a  
22 year since the excavation of most of the cuts there.  
23 I don't think that they are going to be fully stabilized  
24 or become unstable, whichever way they're going to go  
25 for about two to three years, but I think we'll have  
26 a very good indication of how the measures are acting  
27 after one year and I think next spring we will know  
28 a lot more and I would say perhaps we'll know 60% of  
29 the answer, and I think by the second year about 90%,  
30 and by the third year, 100%.



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1 THE COMMISSIONER: Right.

2 MR. GIBBS: Q What is your  
3 view towards the maintenance of erosion controls  
4 following construction?

5 A We recognize that design  
6 and construction control for preventing erosion will  
7 not be fully effective and that a program of maintenance  
8 and repair will be necessary during the first few years  
9 of pipeline operation. A maintenance manual will prim-  
10 arily follow the procedures set out in the design change  
11 manual and will describe treatment methods to be  
12 applied to a variety of erosion conditions set out.  
13 In some cases it may be necessary to install alternative  
14 control measures, or in other cases it may be sufficient  
15 to repair one that has been established but is not  
16 fully effective. We expect that maintenance procedures  
17 can be fully specified during the final design and  
18 construction periods.

19 THE COMMISSIONER: I think  
20 we'll stop for coffee now, Mr. Gibbs. Thank you, sir.

21 (PROCEEDINGS ADJOURNED FOR FEW MINUTES)

22 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

23 MR. GIBBS: Q Now, Dr. Vaartnou,  
24 we get to the important part now, the farming part.  
25 Dr. Vaartnou, you're a consultant to Foothills Pipe  
26 Lines on matters relating to vegetation?

27 WITNESS VAARTNOU: Yes.

28 Q Does the sheet attached  
29 to the prepared evidence and having your name at the  
30 top accurately describe your academic qualifications and



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1 experience?

2 A Yes.

3 Q Would you read the  
4 contents into the record, please?

5 A My education. I studied  
6 plant science --

7 THE COMMISSIONER: What page  
8 is that at?

9 MR. GIBBS: Page 70, sir.

10 THE COMMISSIONER: Sorry.

11 A Studied plant science  
12 and agricultural economics at the University of  
13 Tartu in Estonia, and at the Royal Agricultural College  
14 in Uppsala, Sweden. - Received Bachelor of Science in  
15 Agriculture in 1949. Master of Science in Agriculture  
16 in field of plant science in 1953, University of  
17 British Columbia. Doctorate of Philosophy in grass  
18 ecology and taxonomy, Oregon State University,  
19 Corvallis, Oregon.

20 My experience, 1942-1944, I  
21 taught at Koljala Agricultural School in Estonia.  
22 Subject area of management of forage crops.

23 1944 to 1949, worked as a  
24 research associate in the Institute of Plant Husbandry  
25 at the Royal Agricultural College in Uppsala, Sweden.  
26 My field was plant growth hormones as they  
27 affect the growth of plants.

28 1950 to 1953, worked as a  
29 graduate research assistant at the University of  
30 British Columbia's Department of Plant Science. This



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1 was in the field of plant ecology, specifically inves-  
2 tigating environmental effects of plant biochemistry.

3 1954 to 1959, worked as a  
4 research assistant and specialist in the fields of  
5 turf research and plant biochemistry.

6 1959 to 1966, supervised  
7 University of British Columbia's grounds and botanical  
8 gardens, landscape maintenance, construction and design.

9 1967 to 1968, employed as a  
10 research scientist in forage ecology at the Research  
11 Station in Beaverlodge, Alberta. I established a genea-  
12 ecological garden for northern grasses and surveyed  
13 and collective native ecotypes and naturalized land-  
14 races of grasses from Northern Alberta, British Columbia,  
15 Saskatchewan, the Yukon, Alaska and the Mackenzie Valley.  
16 These plants were selected and collected at 50-mile  
17 intervals from Vancouver to Fairbanks; from Edmonton  
18 to the Beaufort Sea (Garry Island); and from Prince  
19 Rupert to Northern Saskatchewan. They were planted in  
20 a uniformity garden at the Beaverlodge Research Station  
21 for future study.

22 1969 up to present, during 1969  
23 and '70, I worked as a supervisor of plant pathology at  
24 the Plant Industry Division of Alberta's Department of  
25 Agriculture and since 1971 have been the head of the  
26 Botany Section of that department's Plant Industry  
27 Laboratory.

28 During the last four years I  
29 have been actively engaged in reclamation research for  
30 the purpose of re-vegetating disturbed, uncultivated



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1 areas in Alberta. This work is carried on through the  
2 co-operation of the Alberta Departments of Agriculture,  
3 Environment, Highways, and Lands & Forests; various  
4 departments of the University of Alberta; and private  
5 industry.

6 Beginning this year, I am also  
7 project leader for empirical revegetation research for  
8 the Alberta Oil Sands Environmental Research program,  
9 which is financed by the Alberta and Canada Department  
10 of Environment.

11 Q Dr. Vaartnou, your  
12 publications relating to reclamation are those listed  
13 in Appendix "A"?

14 A Yes.

15 Q What is the purpose of  
16 your testimony before this Inquiry?

17 A I am testifying to des-  
18 cribe the revegetation program of Foothills Pipe Lines  
19 Ltd. The objective of this program is to help restore  
20 a self-supporting ecosystem along the right-of-way and  
21 in other areas disturbed by the construction of the  
22 pipeline.

23 Q Are you responsible for  
24 anyportion of Foothills' environmental plans?

25 A As a consultant to Foot-  
26 hills since July 31, 1975, I have helped prepare the  
27 draft of the "Applicant's Response to the National  
28 Energy Board Deficiency Letter No. 5, Question 10"  
29 and<sup>I</sup>/have identified areas requiring further research --  
30 some of which is now in progress. I am also responsible



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1 for preparing Foothills' revegetation specifications.

2 Q Have you made use of the  
3 research of other experts in this field?

4 A Yes, I have. The works I  
5 have consulted are listed in Appendix "B".

6 Q What is the objective of  
7 Foothills' revegetation program?

8 A The objective of the  
9 program is to help nature restore a self-supporting  
10 ecosystem through rehabilitation of the areas dis-  
11 turbed by pipeline construction and related activities.  
12 This will be done by using ecotypes or species currently  
13 found in the area as much as possible. The program is  
14 designed to help protect and restore the soil temper-  
15 ature regime and to aid in the control of erosion  
16 by revegetating disturbed areas as soon as possible after  
17 construction. This must be done on both an immediate,  
18 short-term basis and also over the long run. The  
19 immediate benefit which revegetation provides on a  
20 short-term basis is a reduction in wind erosion and in  
21 erosion by surface runoff.

22 Finally, when the revegetation  
23 program has been completed, the area that had been  
24 disturbed by construction activity will be left in an  
25 aesthetically pleasing state.

26 Q Please outline the reve-  
27 tation program proposed by Foothills Pipe Lines.

28 A We propose to use fast-  
29 growing native grasses and naturalized landraces of  
30 introduced grasses, selected from various locations



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1 in the Mackenzie Valley, in order to quickly establish  
2 initial ground cover. Canadian Arctic Gas, on the  
3 other hand, appears to intend to use agronomic varieties.  
4 We also plan to use seed of some native legumes and  
5 native shrubs, if possible.

6 THE COMMISSIONER: Excuse me,  
7 Dr. Vaartnou, agronomic varieties are imported, is that  
8 is not the equivalent?

9 A Not necessarily. Agron-  
10 omic varieties is varieties developed usually for  
11 forage quality and quantity, and the main purpose  
12 of the there is the yield/vegetative material which can then  
13 be harvested. They might be both introduced exotic  
14 species, or native species, if developed locally.

15 But as much as I know there is no native  
16 species developed in Mackenzie Valley, so all of them  
17 should be considered introduced from one location or  
18 the other, from America, or most of them introduced  
19 from Europe, but basically developed for quality and  
20 quantity of the forage or some long grasses for the  
21 beauty of the heavy maintenance requirement as lawns,  
22 around a house.

23 Q All right, thank you.  
the

24 A In/areas which are  
25 difficult to rehabilitate by seed, we will also be  
26 using vegetative propagation through the technique  
27 of shredding, using rhizomes, stolons, root stalks, and  
28 stem cuttings. In addition some river banks may be  
29 hand-planted using both stem cuttings and rooted  
30 cuttings.



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MR.GIBBS: Please define the terms

"native species, naturalized landrace, agronomic  
variety" and also elaborate on how ecotypes of the  
same species can differ from each other.

A A native species is a  
species developed through natural evolution in a  
certain geographical area. A naturalized landrace  
is a race of an introduced species developed in and  
adapted to local environmental conditions so that it  
is able to survive in competition with native species.

An agronomic variety is a  
variety of an introduced or native species developed  
for forage yield and quality, or as a lawn grass for  
landscaping purposes.

Ecotypes of natural varieties,  
developed in local micro-environmental conditions are  
adapted to a certain soil and climatic conditions.  
They may differ from each other through demands of  
soil diet, nutrition, moisture, temperature, bio-  
competitive ability, disease resistance, seasonality,  
root systems, and color production.



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Q Why do you intend to use  
native species and naturalized <sup>land</sup> races of agronomic species  
rather than agronomic varieties as indicated by Arctic  
Gas?

A Native ecotypes developed  
under local environmental conditions are obviously suited  
to their local environment. Usually they are resistant  
to the local diseases and can be considered as the most  
suitable for rehabilitation disturbed areas.

Plant growth regions can  
best be used to select a species considering that,  
where a plant occurs in one part of the region, it can  
be successfully grown in all parts of that region  
providing that it be planted in situations similar  
to those in which it grows as a native..

Until we have more infor-  
mation about the interaction of tests with plants in  
various environments, the safest strategy is to favour  
a diversity of plant species of local genetic  
origin.

Commercially available  
agronomic varieties developed for yield and forage  
quality are usually susceptible to northern diseases  
such as snow mold and other cold tolerant diseases.  
These agronomic varieties will not provide permanent  
ground cover and, instead of helping in the establish-  
ment of natural regrowth, will prohibit or delay it. To  
clarify ecotypic differences and demonstrate some  
diseases, I would like to show a few slides.



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1 Right here, we have at  
2 presently testing agronomic varieties and native  
3 ecotypes in various natural soils, without any fertil-  
4 izer. There is sand -- natural sand, silt, peat.

5 Tailing sand is considered  
6 one of the lowest or no nutrition containing material  
7 and the tar sand was considered to be one of the most  
8 severe conditions where the plant could grow.

9 In this case, this is  
10 Alopecurus pratensis or Meadow foxtail. That's one of the  
11 best agricultural varieties for northern areas. It  
12 indicates that it grows very well silt and peat without  
13 any fertilizer where the natural fertility level is  
14 quite high.

15 THE COMMISSIONER: Is the one in the middle  
16 peat.

17 A This one is peat. I am  
18 sorry the slide didn't come out very well.

19 And since usually quite  
20 rich in the nutrition point of view. None of them have  
21 got any additional fertilizer. You come to the sand  
22 and tailing sand and tar sand -- the growth is very poor  
23 and usually after three or four months, the plants are  
24 not able to survive there.

25 Now, if we go to here.  
26 Some of this local natural ecotypes -- nature ecotypes.  
27 This ecotype of slender wheatgrass is collected close  
28 to Fort Norman and you could see at the early growth  
29 of this ecotype of slender wheatgrass is very similar  
30 to each soil type. There is really no difference. Yes,



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1  
2 there is -- a little bit more dense growth of those ones  
3 but actually it could be started very well on each  
4 soil type provided that that there is a moisture avail-  
5 able to get the seed growing.

6 Now, I can demonstrate the  
7 ecotypic difference. This is Western wheatgrass,  
8 Agropyron smithii. This on the next light indicates  
9 two different ecotypes selected close by the same  
10 environmental district from various soil types.

11 This one is selected  
12 from very poor soil type. You can see if we plant the  
13 same ecotype in the greenhouse soil with the best  
14 growing conditions and fertilized tailing sand was the  
15 worst conditions. You can see in both cases, this  
16 ecotype grows very well.

17 Now, we see the same  
18 species that selected originally from the good soil  
19 about twenty miles farther than the other ones.

THE COMMISSIONER:

20 Q Excuse me. Selected from  
21 the what soil?

22 A Very good soil.

23 Q Good soil.

24 A Very fertile soil. Now,  
25 if we plant this in greenhouse soil, it grows as well  
26 as other ecotypes that you think this ecotype is  
27 developed in the very poor conditions, or very good  
28 type conditions, sorry. Now, if we plant it in soil  
29 that is really very, very poor, you could see the  
30 difference and that is one of the basic criteria



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1  
2 that has been for me<sup>to</sup> selecting the ecotypes for none  
3 maintained conditions for revegetation purposes.  
4  
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Over here again another  
agronomic variety, in this case smooth loam.  
If we plant it in regular clay soil, good soil  
it grows very well. If we plant it in a tar sand, that  
is one of the poorest conditions, really there is no  
growth. If we mix those two soils we get some average  
growth, and that is what we can expect if we plant  
that in the field. We require a heavily fertilized  
area maintained in order to be able to keep that  
plant in.

Now the other aspect on/<sup>the</sup>re-  
point  
vegetation/is acidity. Over here we compare four  
Ph. levels starting from the Ph-3.5, 5.7, and 9.5.

This case again is the same species as the  
previous light loams in areas of smooth loam. You  
could see it in near neutral conditions, in near  
neutral 7 and near neutral 5. This species is  
reasonably well-adapted and can be grown. If you go  
to acid conditions, Ph-3.5, you see that plant is  
not going to survive very long. If we go to the 9.5  
this variety did not grow at all.

So it means that there is  
so limited a range for this variety to be useful for  
revegetation purposes, and this is one of the best  
forage grounds.

Now, if we go to the native  
ecotypes again, the same as I mentioned before, slender  
wheat grass, you can see it, there is better growth on  
7 and 5, but this one is adapted to the more acid  
condition and the growth on Ph-3.5 is reasonably good.



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1 But this species is not adapted to the high level  
2 either, but we could expect that we would use, and  
3 this would be ~~be~~ more successful on lower Ph. areas.  
4 But we can expect certain areas in the Mackenzie Valley.

5 Now, there is another native  
6 grass that we are planning to use on these sandy  
7 <sup>the</sup> tills where ~~erosion~~ control is necessary. This grass

8 Festuca saximontana is native in northern areas here.  
9 It does not grow very much on the surface. This grass,  
10 the production of the surface is approximately 20-25%  
11 of the growth. 75 to 80% of the growth occurs before  
12 -- below soil level, or inside the soil in the roots

13 growth and for sandy stabilization, for sandy slopes  
14 in ~~northern~~ areas dry conditions, it is one of the best  
15 grasses. and it grows <sup>very</sup> well on nearly every Ph-level  
16 of 3.5, 7 and 11, so the latitude on that point of  
17 view, another test has indicated that this grass has  
18 no response to the fertilizer and the latitude on  
19 the soil conditions it does not grow on heavy glaze,  
20 that is loose sands. It is a very good and it's a very  
21 wide latitude on Ph point of view and as much as I  
22 could see, this one would be the one of the best grasses  
23 to use for stabilization of sandy slopes.

24 Now I mentioned one was before  
25 the disease resistance. I think this aspect is not  
26 pointed out very much. When I get into Northern  
27 Alberta, 1967, first the thing was asked to me to  
28 find out the winter damage. Now, it is believed that  
29 the cold is the one what kills the plants in the  
30 winter. We started to look around on perennial grasses



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1 introduced grasses in Beaverlodge area, and we found  
2 at Beaverlodge, 75 to 90% is not the cold killing  
3 the grass but cold-resistant diseases and in that  
4 case sclerotinia borialis is one of the northern snow  
5 moulds and this nursery, this is my nursery in the  
6 centre this demonstration of 16 varieties of agrostis  
7 introduced from States and Europe. Both sides here  
8 and here, the picture does not show all the area, is  
9 the selection what I brought down from the north,  
10 local ecotypes. It appeared to me that it's suggested  
11 that one of the agrostis to be used on revegetation of  
12 Mackenzie Valley is seaside bent grass. Seaside bent  
13 grass  
/is one from this point to this point.

14 Varieties developed in  
15 Southern Oregon are not necessarily resistant to the  
16 local diseases here. Other varieties demonstrate that  
17 there are varieties within that species quite  
18 disease.  
resistant to the/ They are the same species. They  
19 are introduced also, but there is resistance, but  
20 before we select the variety of the lawn grass and  
21 the forest crop, we should consider these grasses  
22 resistant to the cold but not resistant to the local  
23 diseases, and you would see that one year, '67, all  
24 the grass grows very well. There was no difference.  
25 But we have to remember that part and a severe winter  
26 on the seeds' point of view in the northern areas occur  
27 usually every five or seven years once, so, if we  
28 use the varieties that are not resistant to local  
29 diseases, if we are lucky we could grow them six years.  
30 If we are unlucky, it would begin the first year.



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1 That's what happened in '74 when most of the varieties  
2 planted in the north was lost.

3 So, it depends when the severe  
4 winter occurs. Severe winter, not from the point of  
5 view of the cold, but severe winter from the point of  
6 view of plant diseases. In this case, sclerotinia borialis  
7 northern snow mould.

8 Another point from <sup>the</sup> disease  
9 resistant point of view, if you use too much fertilizer  
10 you force the plant to grow too late in the summer, and  
11 the plants do not have time to prepare for the winter  
12 diseases or cold later, and using unnatural quantities  
13 of fertilizer you could force the plant to be killed  
14 in the wintertime, instead of trying to help the plants.  
15 You get nice green growth the first summer, but you  
16 make the plant very susceptible to the diseases and  
17 winter cold.

18 WITNESS BOUCKHOUT:

Excuse

19 me, could you go back to that previous slide for a  
20 second? Perhaps you should just summarize it just  
21 a bit.

22 MR. GIBBS:

Q Am I correct in saying

23 that the dead parts which are shown in the slide there  
24 had grown the previous year and had survived the  
25 previous year but over the next winter they'd died.  
26 Is that correct?

27 A Yes.

28 Q <sup>your</sup> hat's parallel to saying

29 that they've grown well the previous year but over  
30 that winter when the snow mould hit them they died



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1 out and only those who were resistant are the ones  
2 who are growing this current year?

3 A That's right. These  
4 were actually planted in '66. They grow very well,  
5 everything was established very well in '66. They  
6 survived the winter of '66-'67, they grow very well  
7 in '67, but winter '67-'68 they do the damage, and if  
8 I compare with the same species, this one here, the  
9 redtop, and this one here is redtop, variety. One is  
10 a variety, one is selected from 1019 Yukon. You could  
11 see that there is very little damage of three plants  
12 out of 50; on the local this is landrace variety,  
13 agricultural variety, 100% killed. Other ecotypes  
14 for sub-species of the same species, so called highland bent  
15 grass was 100% killed. There is creeping bent grass,

16 The name to me is agrostis stolomifera, but other people is using  
17 palustris too.

18 this is seaside bent grass here. You can see it  
19 are 1, 2, 3, 4, 5 plants survived out of 50.

20 Some other species such as  
21 agrostis canina, it's very good again but I  
22 guess it is not used, it is used only as a lawn grass  
23 but from a disease point of view it is very good.  
24 One of the agrostis tenuis survived very well too.  
25 It is again a landrace. It is selected by Dr. Kallio  
26 in Alaska, <sup>it's</sup> introduced, obtained variety and I  
27 guess that's obtained from him. It means there is  
28 possibilities that environment itself could select out  
29 of landraces resistant to the local diseases, but we  
30 have to consider that the three types of grasses, if  
this is seaside bent grass like nugget Kentucky Blue-



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1 grass, you don't expect that that grass can be  
2 improved in local conditions. It is cross-fertilizing  
3 species like fescue or some other grasses, agrostis.  
4 Nature itself could select out lawns resistant to  
5 the local conditions. That's a fair type of the  
6 grasses that are self fertile. There is again little  
7 bit latitude to selection on short-term basis  
8  
9  
10  
11  
12  
13  
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30



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(MR. VAARTNOU CONT'T)

that the variability in the cross-breeding or crisis,  
it is a very great and usually if you take time, within  
a few generations, you could select the material  
adaptable to any environmental conditions but if it's  
self fertile you have to go to the raiser and expect  
nature to do it within 10,000 years or more if  
necessary.

WITNESS BOUCKHOUT: Dr.

Vaartnou, was there any indication that CAGPL  
was intending to use any of the grasses used in the slide  
there?

WITNESS VAARTNOU: Only this  
one here.

MR. GIBBS: Perhaps we could  
go back then to your evidence now, Dr. Vaartnou. Dr.  
Vaartnou, will you be applying large amounts of  
fertilizer to promote the growth of the grasses?

A The fertilizer program  
will be designed to promote active and vigorous root  
growth. Vigorous top growth will be promoted only  
when it is needed for perma frost protection. Native  
species do not require as much fertilizer, Commercial  
or agricultural varieties<sup>to</sup> need to be healthy and  
therefore we intend to use a minumum amount. This  
procedure results in minimum disruption to the natural  
Ecosystem.

Q Could you describe the



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re-vegetation method you plan to use?

A We plan to use aerial seeding by helicopter on the main line and other areas as much as possible. Some areas will necessitate incorporation of the seed into the soil and these will be seeded using ground equipment such as Brillion seeders, harrows, rollers or other equipment dictated by the ground surface.

use  
We will/shredding to facilitate vegetative propagation when using native ground cover material. The method of shredding has been used in horticulture, on golf courses and other areas, where vegetative propagation is the only method for propagating certain varieties which cannot be propagated by seed. Using this method, plants can be multiplied at least ten times and rejuvenated.

Hand planting will be employed when rooted and unrooted cuttings are used.

Q Could you be more specific about areas which may need ground equipment for seeding.

A River banks, borrow pits, construction sites, some steep slopes, some loose sandy soils, and small areas around compressor stations may need ground seeding. Also, the areas requiring vegetative materials for rehabilitation will be planted using shredders, rototillers and rollers.

Q In what way is shredding different from using sod to obtain plant growth?



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1  
2  
3 A Using sodding methods, you  
4 apply a separate layer to the sodded area, and if the  
5 texture of the soil in the sod is different from the  
6 layer below, the roots will usually stay in the applied  
7 layer and will be quite susceptible to the sub-surface  
8 erosion between layers, especially on slopes.

9 Shredding, on the other hand,  
10 is similar to planting, as you incorporate the material  
11 into the existing surface and there are no layers  
12 created.

13 Q Where will you obtain the  
14 material to be shredded?

15 A The material to be shredded  
16 will be collected from the ditchline before it is  
17 excavated. The top growth plus two to four inches of the  
18 soil, containing the roots and rhizomes of the native  
19 plants, will be removed prior to excavation of the  
20 ditch and will be used immediately further down on the  
21 line or will be stored for later use in areas where it  
22 will be needed.

23 Q What techniques will be used  
24 should the vegetation on snow roads be damaged?

25 A If there is sufficient live  
26 material underground to initiate the growth, then light  
27 fertilization will be used to improve recovery. In  
28 areas such as this, reseeding is ineffective because the  
29 new seedlings will be in an inferior position bio-  
30 competitively as compared to the growth from existing



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1  
2  
3 roots and rhizomes. However, if the existing plant  
4 cover is completely destroyed, then the area will be  
5 rehabilitated using the seeding or vegetative methods  
6 described earlier.

7 Q Is seed of native species  
8 and naturalized landraces of agronomic species available  
9 in sufficient quantity for revegetation of a project of  
10 this scale?

11 A At present, these varieties  
12 are not on the commercial market. However, we have  
13 sufficient stock to increase the seed on a contract  
14 basis, within two to four years, depending on the  
15 variety and quantity required, so that there will be  
16 more than enough seed to rehabilitate the whole area  
17 disturbed.

18 Q Has Foothills Pipe Lines  
19 Ltd. contracted to grow the necessary seed?

20 A Yes, they have made  
21 arrangements to start multiplication of these varieties  
22 in the spring of 1976.

23 Q By what year will this seed  
24 have been multiplied sufficiently to revegetate the pro-  
25 posed pipeline route?

26 A There will be sufficient seed  
27 available to to revegetate a thousand acres by 1978,  
28 3000 acres by 1979 and virtually unlimited quantities  
29 by 1980 and thereafter.

30 Q What steps must be taken to



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monitor and evaluate the success of the revegetation  
program?

A Monitoring and evaluation  
will be carried out under the direction of a qualified  
plant scientist. The area rehabilitated will be  
regularly inspected by qualified technicians under the  
supervision of the plant scientist. This will be done  
by aerial survey and by ground survey. Areas found to  
be inadequately rehabilitated will be revegetated at the  
first opportunity.

Q Are you satisfied that, using  
present knowledge and with some additional research,  
the areas disturbed can be rehabilitated?

A Yes. There is no reason  
why the disturbed areas can not be rehabilitated using  
current scientific knowledge, technology and experience,  
and good farmer's knowledge.  
However, to ensure maximum success in creation of a  
self-supporting ecosystem, native species adapted to  
the local environmental conditions should be used from  
the outset. In order to upgrade current knowledge, we  
are and will be conducting research to ascertain the  
techniques necessary to be used and to determine species  
adaptability in certain micro-environmental and site-  
specific conditions.

MR. GIBBS:

Mr. Commissioner, there  
was circulated with the prepared evidence an Appendix C,  
which was Dr. Vaartnou's responsibility. We had not  
intended to read it in but to have him adopt<sup>it</sup> and then



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with your permission to mark it as an exhibit.

THE COMMISSIONER: Fine.

MR. GIBBS: Dr. Vaartnou, is  
Exhibit C, the contents of that prepared by you?

WITNESS VAARTNOU: Yes.

Q And you adopt that also  
as your evidence?

A Yes.

Q I am sorry, Appendix C  
entitled "Proposed Revegetation Specifications"?

A Yes.

Q Might that be marked then?  
(APPENDIX C, "PROPOSED REVEGETATION SPECIFICATIONS"  
MARKED EXHIBIT 311)

MR. GIBBS: Perhaps you should  
point out sir, that on page 3 of exhibit 311, Dr.  
Vaartnou says that in addition to applying all relevant  
scientific techniques, the know-how of a successful  
farmer is needed. That is perhaps my next retainer.

MR. MARSHALL: I can see the  
fine hand of Mr. Gibbs involved in the preparing of  
some of this evidence sir. You have been a busy man.

MR. GIBBS: Now, Mr. Lawrence,  
you are past president and past chairman of Associated  
Engineering Services Limited, a consultant to Foothills  
Pipe Lines Ltd.?

WITNESS LAWRENCE: Yes.

Q In what capacity are you



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testifying?

A I am testifying on behalf  
of Foothills Pipe Lines Ltd. as a consultant retained  
by AESL in the fields of water supply, sewage disposal  
and solid waste disposal.

Q Does the sheet attached  
to the prepared evidence and having your name at the  
top accurately describe your academic qualifications  
and experience?

A Yes.

Q Will you read the contents  
of the sheet please and would you specify the page  
number of that?

A Page 74. Education -  
personal engineer, civil engineering, graduated in 1941  
from the University of Alberta, served with the Canadian  
Army overseas. Experience - 1946 as a designer in the  
city of Edmonton Water Treatment Plant, 1947 and 1948 as  
a structural engineer with C. W. Carrie Ltd., steel  
fabricators. Late in 1948 I joined a private consulting  
firm and founded Associated Engineering Services Ltd.  
in the fields of municipal engineering, water supply,  
and sewage disposal. I became president of Associated  
Engineering in 1954. In 1969 I took the position of  
chairman on the board of directors. In 1973 I retired  
to pursue other interests, but I am still retained by  
Associated Engineering Services Ltd. in various  
engineering projects. Since 1948, I have been personally



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1  
2  
3 involved with General Municipal Engineering in western  
4 Canada. When the federal government undertook a  
5 program of studying construction utilities in northern  
6 settlements in 1957, I headed the Associated Engineering  
7 Services team involved in various communities along  
8 the Mackenzie Valley and the Arctic coast. These  
9 include Aklavik, Fort MacPherson, Tuktoyaktuk, Fort  
10 Simpson, Fort Franklin, Fort Liard. Since that time  
11 I have been involved in the continuing studies and in  
12 construction of utilities in most of the northern  
13 communities including Enterprise, Fort Gray, Edzo,  
14 Norman Wells, Fort Good Hope and Inuvik. Communities  
15 outside the MacKenzie Valley include Alert, James Bay,  
16 Strathcona Sound in the Northwest Territories and  
17 Whitehorse, Faro, Mayo, and Watson Lake in the Yukon.  
18 I also undertook two studies on the North Slope of  
19 Alaska. All the above have been related to community  
20 planning with particular reference to water supply and  
21 waste disposal.

22 Q Is there a difference in  
23 concept between the proposals in this area between the  
24 between Arctic Gas and Foothills?

25 A No, our Associated Engineering  
26 Services Limited team helped develop both proposals and in  
27 doing so took into consideration the environmental and  
28 public health concerns expressed by government agencies.  
29 The proposals and recommendations involve a high standard  
30 of procedures and equipment.



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1  
2 In developing the concepts  
3 we referred specifically to the requirements of  
4 various acts and regulations listed in the bibliography  
5 attached hereto and attempted to adhere to the guide-  
6 lines being developed by the Environmental Protection  
7 Service.

8 Q As related to construction  
9 camps and compressor stations, what are the basic  
10 procedures and components of the water supply systems?

11 A Along the pipeline  
12 route there is, in general, no shortage of raw water. A  
13 supply source will have to be identified for each site.  
14 Tanker trucks will provide basic transportation. These  
15 will be supplemented by portable pipelines depending on  
16 site and weather. Treatment will generally be chlorina-  
17 tion and filtration. However, provision may have to be  
18 made for other treatment processes such as aeration,  
19 sedimentation, and iron removal. "Package" treatment  
20 plants will generally be employed.

21 The basic procedure will be  
22 varied to meet the requirements of camp size, location  
23 and season. For camps intermittently occupied in the  
24 operational phase, water storage will be introduced to  
25 overcome supply and treatment problems. This means that  
26 large tanks will be installed in protective enclosures.  
27 They will be filled periodically during the year when  
28 conditions at that particular site are favourable. The  
29 tank size will be such that it will provide for projected  
30 usage for periods of 6 to 12 months.



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Q Can you provide a similar  
outline of the basic procedures regarding sewage  
treatment?

A The basic camp components  
for receiving and collecting of camp wastes are standard  
items. These are the sinks, toilets, basins and floor  
drains. Collection to a central point will generally  
be by utilidors.

Disposal of waste water  
is a critical item. Several principles concerning  
waste disposal have been formulated:

1. Project and camp  
management will include the provision and supervision  
of trained operators.

2. All waste water will  
be treated prior to discharge.

The target for camp  
wastes will generally be secondary treatment. This  
generally involves the removal of floating and settleable  
solids together with either biological or physical/  
chemical treatment of the liquid to effect a reduction  
in BOD and suspended solids to a set standard.

We have recommended  
that the treatment standard shall be for 20 milligrams  
per litre of BOD and 25 milligrams per litre of sus-  
pended solids in the final effluent. We believe this  
will meet E.P.S. guidelines as it is a high standard.  
These guidelines are under constant review and thus  
revisions can be anticipated.



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I note that BOD means  
Biological Oxygen Demand or the amount of oxygen required  
to prevent the liquid from becoming septic.

3. With prior approval,  
small temporary camps may target for primary treatment  
only. In application, this will be specific task units  
operating under conditions which would make further  
treatment impractical.

4. All treatment plants  
will have "back-up" units. In most cases, this would be  
in the form of retention ponds capable of retaining all  
liquids from a camp for a minimum of 15 days. The form  
of this retention pond will vary from site to site de-  
pending on soil type and stability and the presence of  
permafrost or ice lensing. Consideration will be given  
to the formation of ice sheets in the area of discharge.

5. Wherever possible, the  
discharge of treated wastes will be onto wetlands rather  
than into bodies of water -- particularly if such bodies  
of water are not capable of providing massive dilution  
on mixing.

6. Chlorination and  
sterilization will not be resorted to unless there is a  
direct danger of contamination -- contaminating -- a  
downstream drinking water source.

7. In the operational  
phase, treatment units will generally be retained for  
use during periods of intense activity (for example, a  
30 man crew doing maintenance). For intermittent



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1 occupation, wastes will be collected in a holding tank  
2 located in the occupied quarters and discharged directly  
3 into a retention pond adjacent. This pond will be  
4 capable of retaining all liquids for a period of one  
5 year.

6  
7 8. In the treatment  
8 processes, there are a variety of "package plants" avail-  
9 able on the market. The actual choice of units has not  
10 been made. Two basic types are being considered:

11 (a) Biological (or  
12 activated sludge) plants which use the action of bac-  
13 teria to accomplish the treatment process. Produced  
14 sludge would be disposed on land.

15 (b) Physical/chemical  
16 plants which use chemical precipitation and filtration  
17 to remove BOD of suspended solids. Produced sludge  
18 would be incinerated.

19 Site conditions for  
20 each treatment plant must be carefully considered in  
21 relationship to permafrost and soil types as well as  
22 the potential effects on the land and water adjacent.  
23 The combination of methods installed for treatment will  
24 have to be site-specific.

25 Q Can you provide us with a  
26 similar outline of the basic procedures regarding solid  
27 waste disposal?

28 A The solid waste problem  
29 has to be divided in two parts -- non-organic and  
30 organic.



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1 Non-organic wastes will  
2 also have many forms. Large items such as derelict  
3 vehicles and equipment, waste pipe, etc. will be  
4 collected and returned for recycling (i.e. scrap steel).  
5 Many smaller objects of metal will likewise be collected  
6 for return and recycling. A large variety of items will  
7 be collected and buried at an approved site by approved  
8 methods.

9 They could well be  
10 incorporated into filled areas.

11 Organic wastes likewise  
12 will come in many forms. Where salvage is practical,  
13 recycling will be instituted. The majority of the  
14 organic wastes will be disposed of by incineration. The  
15 acceptable characteristics of incinerators have been  
16 proposed to the Commission as part of the proposed  
17 Environmental Code by the Environmental Protection  
18 Board.

19 Q In your opinion, will the  
20 methods which you have recommended be adequate to meet  
21 the suggested standards as set out by the Environment  
22 Protection Service?

23 A The mechanics of the methods  
24 proposed will meet these standards. Supervision of  
25 trained operators and monitoring of the results of  
26 treatment will ensure adherence.

27 Q What will happen to <sup>the</sup> various  
28 treatment equipment on completion of the construction  
29 project?  
30



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1                   A     As noted, some of the  
2 equipment will be retained at the various sites to serve  
3 the operational facilities. The local communities will  
4 reserve "right of first refusal" on surplus equipment.  
5 The remainder would be returned for recycling.

6                   Q     Mr. Taylor, you are a prin-  
7 cipal of the Lombard North Group, a consultant to  
8 Foothills Pipe Lines?

9                   WITNESS TAYLOR: A     Yes.

10                  Q     What is your area of  
11 responsibility?

12                  A     I am responsible for  
13 Lombard North's input on aesthetics.

14                  Q     Does the sheet attached to  
15 the prepared evidence and having your name at the top  
16 accurately describe your academic qualifications and  
17 experience?

18                  A     Yes.

19                  Q     Would you read it in please  
20 and would you specify the page on which it is found?

21                  A     Page 81 -- Education. I  
22 have a Bachelor of Science in Landscape Architecture  
23 from Iowa State University in 1962. A Master of Land-  
24 scape Architecture from the School of Environmental  
25 Design at the University of Calgary, or California,  
26 Berkeley, 1964. While there, I studied under R. Burton  
27 Litton, recognized authority on visual analysis.

28                             I also attended Landscape  
29 Resource Analysis and Land Use Seminar, Harvard Univer-  
30 sity in 1972.



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Experience -- 1961--

U.S. National Park Service, Petrified Forest National  
Park, Arizona. Summer field assistant, road and  
boundary surveys.

1962 -- Brower and Associ-  
ates, Edina, Minnesota. Landscape Architect.

1963 -- John Carl Warnecke,  
Architects and Planners, San Francisco, California.  
I acted as a landscape architect.

1964 - 1966 -- Royston,  
Hanamoto, Mayes and Beck, Landscape Architects, San  
Francisco, California. Design and construction  
supervision.

1966 - 1973 -- Man Taylor  
Muret Ltd., Winnipeg and Calgary. Principal responsible  
for numerous open space studies including city and prov-  
incial parks. I was in charge of the aesthetic portion  
of the Mackenzie Highway overview study for DIAND.

1973 to Present -- Lombard  
North Group Ltd., Calgary, Alberta. In charge of the  
planning and landscape architectural division. Have had  
a major involvement in numerous corridor projects includ-  
ing the Mackenzie Highway, The Trans-Canada Highway through  
Banff National Park, the Kananaskis Highway, in Alberta  
and urban freeway impact studies. Have been involved  
with landscape planning, aesthetic and reclamation stu-  
dies related to gas field, tar sands, gravel and  
petrochemical plant development.

Professional Affiliations --



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1  
2 A member of the Alberta  
3 Association of Landscape Architects; Canadian Society of  
4 Landscape Architects; American Society of Landscape Arch-  
5 itects and I am a member of the National Recreation and  
6 Parks Association.

7 Q Would you please explain  
8 the process used in assessing aesthetic concerns  
9 relative to the Foothills project?

10 A An overview inventory of  
11 regional characteristics of primary features was  
12 undertaken initially to provide a basis for aesthetic  
13 evaluation of the proposed pipeline route. The base  
14 line information was established in two phases:

15 The first exercise was to  
16 review available information on recognized physiographic  
17 zones and equal regions of the Northwest Territories.  
18 This material was evaluated as to common aesthetic  
19 characteristics and regional landscape units were  
20 delineated.

21 The second step was to  
22 identify known specific visual zones or features with  
23 regional significance that occur within the pipeline  
24 study corridor. This information was gathered from  
25 prior studies of the Mackenzie Valley and from personal  
26 experience in the area. This work was beyond scope of  
27 that presented in the Canadian or Canada Gas Arctic  
28 submission.  
29  
30



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Q What principles or  
assumptions were used to establish the parameters  
for evaluating the pipeline route in terms of  
aesthetics?

WITNESS TAYLOR: The primary  
aesthetic consideration related to natural visual  
resources and visual perception. Secondary concerns  
included noise and air quality. Visual criteria for  
establishing baseline conditions were generated by  
applying visual principles to other types of environ-  
mental data, notably vegetation, landform, and drainage  
information. Therefore the quality of visual exper-  
ience would be influenced significantly by the health  
of the ecosystem and more specifically the physical  
impact on resources as a result of the project.

Areas of unique, scarce, or  
high visual qualities within the corridor were  
given consideration. A pingo, for example, is an  
unique visual feature. As well, zones of potentially  
high visibility due to terrain conditions or to  
proximity to population centres, transportation routes,  
or other land uses will be given priority. A recreation  
site would be an example of a priority area.

Q How were the regional  
landscape unit zones described and how were they used?

A Six regional landscape unit  
zones were defined for study purposes. These areas  
generally relate to the recognized eco-regions which  
take into account common physical, biological, and  
climatic conditions.



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1 The other element considered  
2 in locating the boundaries of landscape units was the  
3 form of spatial composition evident in each region.  
4 A major factor included the presence and location of  
5 mountain ranges and major river basins.

6 Q What were the areas of  
7 special concern?

8 A The aesthetic concerns  
9 were examined on two levels:

- 10 1. Regional concerns that would provide broad impact  
11 information for application of general protection  
12 measures; and  
13 2. Site-specific concerns dealing with natural  
14 visual features or physical characteristics of the  
15 project requiring special protection measures.

16 Features of principal concern  
17 included:

- 18 1. Right-of-way clearing.  
19 2. Mackenzie Highway crossings, access roads and the  
20 proximity of facilities to use areas.  
21 3. Compressor station sites.  
22 4. Temporary facility sites.

23 Q Were the results of the  
24 overview study later verified in the field and were  
25 there further findings?

26 A Yes, the entire route  
27 was reviewed from the air and supplemented by ground  
28 level observations. Additional information has been  
29 gathered on the community service laterals and recommen-  
30 dations are forwarded as an on-going process.



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Q Now, Dr. Reeves, you are  
the president of Lifeways of Canada Limited.

WITNESS REEVES: Yes.

Q Does the sheet attached  
to the prepared evidence having your name at the top  
accurately describe your academic qualifications and  
experience?

A Yes.

Q Would you read in the  
contents of that sheet, please. What page is it on?

A Page 87. Education,  
B. Sc. in Geology, University of Alberta, 1961.

B.A., Philosophy, University  
of Alberta, 1963.

M.A., Archaeology, University  
of Calgary, 1967.

Ph.D., Archaeology, University  
of Calgary, 1970.

Academic experience, nine  
years. Sessional instructor, Department of Archaeology,  
University of Calgary, 1966 to '70.

Assistant Professor, Department  
of Archaeology, University of Calgary, 1970-73.

Associate Professor, Department  
of Archaeology, University of Calgary, 1973 to present.

Professional experience. 12  
years, Western Canadian Archaeology, 11 in senior  
management positions. President of Lifeways of Canada  
Limited since 1973.

Agency/Clients Report - 40.



Bouckhout, Drew, Claridge  
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1 Consulted as direct or sub-  
2 consultant on various projects, that is highways, coal  
3 mines, pipelines, petrochemical plants, recreation  
4 and urban developm ents.

5 Professional memberships, the  
6 Society for American Archaeology; Canadian Archaeological  
7 Association; American Anthropological Association;  
8 American Association for the Advancement of Science;  
9 Plains Anthropological Association.

10 Published papers and mong<sup>o</sup>raphs  
11 - 17; papers in press - 4; papers presented at  
12 conferences - 22.

13 Q Dr. Reeves, have you under-  
14 taken a preliminary archaeological study of Foothills'  
15 Pipeline system?

16 A Yes.

17 Q What was involved in this  
18 study?

19 A A study of published in-  
20 formation on the regions' archaeological sites and  
21 aerial photo interpretation of the route formed the  
22 basis of the archaeological assessment.

23 Q What was the purpose of  
24 the study?

25 A Its purpose was twofold.  
26 First, to obtain baseline archaeological data on the  
27 corridor, and known site locations in order that a  
28 preliminary assessment could be made of the impact that  
29 construction would have on those sites. Secondly, to  
30 design a program of field studies to mitigate this



Bouckhout, Drew, Claridge,  
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1 potential impact.

2 Q Were any known archaeolo-  
3 gical sites found to lie directly on the line, in  
4 designated construction areas or nearby?

5 A On the basis of published  
6 site location data, no sites are located on the line  
7 or in construction areas. Some, however, such as Fort  
8 Alexander near the Willowlake River crossing, are  
9 located near the line.

10 Q What impact will con-  
11 struction have on known sites?

12 A It will depend upon the  
13 relationship of the site to the proposed line and  
14 facilities and the value of the site. Some known sites  
15 of value which lie off the line could be indirectly  
16 impacted by vandalism, for example.

17 Q How can these indirect  
18 impacts be avoided?

19 A Impact can be avoided by  
20 integrating these sites, when necessary, into an arch-  
21 aeological program planned for the line and project  
22 facilities.

23 Q On the basis of your  
24 study, will unknown archaeological sites lie along the  
25 route?

26 A Yes, it is anticipated  
27 that sites will be found in archaeologically sensitive  
28 areas, particularly at stream and river crossings.

29 Q On the basis of your  
30 preliminary studies, can you make any assessment of the



Bouckhout, Drew, Claridge,  
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1 impact which project construction will have on archaeo-  
2 logical sites not yet found?

3 A Sites will undoubtedly be  
4 destroyed. Whether these are of value or not can only  
5 be determined by an archaeological inventory and site  
6 evaluation.

7 Q Can this inventory be  
8 carried out for the entire system prior to clearing?

9 A No, archaeological sites  
10 are buried some depth below the ground and unless the  
11 ground is disturbed by man or nature, they are not  
12 easily found. Much of the route lies in undisturbed  
13 regions. Sites in these areas will not be found until  
14 some route preparation is done. Other areas of parti-  
15 cular sensitivity, i.e. stream and river crossings,  
16 wharf sites, etc. can be effectively examined prior  
17 to clearing.

18 Q Will sites be disturbed  
19 during line preparation in those areas which will be  
20 inventoried later?

21 A Undoubtedly, however  
22 these would not be located otherwise. Also most will  
23 be of limited value.

24 Q You refer to site values.  
25 How are these determined?

26 A These are determined  
27 through the field inventory and evaluation studies.  
28 Essentially the site and its data are examined in its  
29 relation to the system's impact, and the site's value  
30 to the archaeology of the Mackenzie Valley. Sites



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1 will vary widely in value from ones of outstanding  
2 value, Fort Alexander, for example, to ones of no further  
3 value such as a single stone tool found by itself in  
4 the forests.

5 Q What sort of protection  
6 measures will be taken for sites of value?

7 A A comprehensive archaeo-  
8 logical surveillance program is planned. Those sites  
9 of outstanding value will be avoided by relocating the  
10 line or facilities wherever possible, while those of  
11 lesser value will be excavated prior to construction, if  
12 possible, or after construction if lead time before  
13 construction is insufficient. Outstanding sites will  
14 be monitored during construction to ensure maximum  
15 protection.

16 Q Will all sites be found  
17 prior to laying of the pipe?

18 A No. Certain sites which are  
19 particularly localized or buried deeply below the  
20 ground will not be found.

21 Q What protective measures  
22 will be taken for these?

23 A Construction activities  
24 will be monitored by environmental inspectors who will  
25 have access to a professional archaeologist. Excava-  
26 tions will be undertaken after construction of any  
27 sites of value found during the construction phase.

28 Q What happens to all the  
29 information collected in these various activities?

30 A It will be analyzed and



Bouckhout, Drew, Claridge,  
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1 interpreted and reports written and published. The  
2 artifacts and documents will then be deposited in an  
3 appropriate museum. The information is part of  
4 Canada's heritage and unless it is preserved in an  
5 interpreted form, is of little value, for the  
6 artifacts alone have no value.

7 Q Even though archaeologi-  
8 cal sites will be destroyed, will the program you  
9 have outlined have any positive benefits?

10 A Most definitely. The  
11 identifying of sites and excavation of those that  
12 cannot be avoided and the interpretation of the  
13 recovered data will, in my opinion, far outweigh  
14 the negative aspects of the project. Potentially we  
15 stand to add significantly to what is known of the  
16 prehistoric and historic cultures in the Mackenzie  
17 Valley.

18 MR. GIBBS: The panel may now  
19 be cross-examined, sir.

20 THE COMMISSIONER: Just  
21 Dr. Reeves, Fort Alexander, what -- when was that  
22 established, do you know?

23 A The early part of the  
24 19th century. I'd have to look up the exact date.

25 Q Yes. Dr. Richard Morland  
26 gave evidence before this Inquiry and he said archae-  
27 ology is our only means of reconstructing the history  
28 of human groups that had no writing system. That's  
29 something you'd agree with, I take it?

30 A Yes, I would.



Bouckhout, Drew, Claridge  
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Taylor, Reeves

THE COMMISSIONER: I don't know what the order is, but --

MR. SCOTT: I believe Mr.  
Bayly is first.



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Taylor, Reeves  
Cross-Exam by Bayly

MR. BAYLY: I have just been  
advised by Commission Counsel that he is prepared to  
handled Fort Alexander so I won't address any questions  
on that subject.

I understand it is being  
renamed the Scott Mission.

CROSS-EXAMINATION BY MR. BAYLY:

MR. BAYLY: Q Mr. Bouckhout,  
if I can begin with you as the head of the panel. Having  
looked at both your application and the prepared evi-  
dence and comparing it with that of Arctic Gas, I am  
unable to find any reference to borrow requirements  
or sources of borrow material. There is one reference  
to riprap for bank stabilization. Have you done studies  
to determine how much gravel and other select material  
you will require and where it is going to come from?

WITNESS BOUCKHOUT: A Yes.  
I believe the -- I'm not so aware as the engineering  
panels that we had on broached that particular subject.  
There have been some studies done. The initial  
preliminary studies done on the basis of the DIAND  
inventory. Our people have projected some of the borrow  
requirements that would be available. We are by no  
means, I don't believe, at the final stage. We haven't  
done any field work from the materials quality point  
of view. We have done field work from the biological  
point of view having had our biologist in the field  
this summer looking at those sites which were designated  
as potential sites by our engineering department.



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Cross-Exam by Bayly

Q Would you then be at the stage that Dr. Mollard was at when he gave evidence he had looked at the photo-mosaics identified from sites and done some ground reconnaissance to have a look at and visually assess some of the sites and to give a general figure of the quantities available?

A I believe that is probably the stage we are at. As I say, we depended a fair bit on the perennial inventory of DIAND and from that looked at the locations of some of the potential pits and the extrapolated potential quantities of material in those pits and types of material, etc.

Q All right then. You have looked at some of the areas and perhaps you can identify for the Commission the areas where you feel there will be shortages of material, either resulting in having to use material you would rather not use, or where you <sup>would</sup> have to use longer hauls than would normally be termed economical and convenient for the project.

A Well, to my knowledge, sir, there won't be any shortages per se, there will be some constraints as you mentioned. In some cases longer hauls or long hauls might be required to get the material. However, I really couldn't say that there would be shortages. I have been told by our people that there is sufficient material available.

I couldn't comment further on that since I am not involved in the actual material requirements per se.



~~Bouckhout~~, Drew, Claridge,  
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Taylor, Reeves  
Cross-Exam by Bayly

Q All right. Is that  
shortage -- there will be no shortage of material for  
you or there will be no shortage of material for you  
and competing and subsequent users of the material?

A Well, I don't know exactly  
how much material is going to be required for other  
users. However, from our requirements projected to date,  
which as I have mentioned are not exact, it appears that  
of the pits that we have designated and the volumes of  
material we have designated to use from those pits  
compared to what the DIAND inventories indicated is  
in those pits. We're well below taking even half. In  
fact, I believe for our general fill requirements from  
those pits we're somewhere in the range of 8 to 16% and  
for concrete aggregate type material we're somewhere in  
the range of 0.8 to 2% or something.

Now, I should qualify that  
saying that that is only the material which DIAND has  
indicated is in the pits that we are looking at. Now,  
they have indicated other sources along the line which  
I am not taking into account when I am giving you that  
figure calculation.

Q And in this is based on  
some general assessment that you have made of your  
requirements. I know you can't be exact but we do have  
a figure from Arctic Gas of 30 million cubic yards as  
an approximate amount that they will take and I would  
be expecting them to be able to tell us within a  
thousand yards, or perhaps even a hundred thousand yards,



Bouckhout, Drew, Claridge,  
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Taylor, Reeves  
Cross-Exam by Bayly

1  
2 exactly how much material they will require.

3 A That's right.

4 Q How close are you to being  
5 able to give me a figure within a million yards for  
6 example?

7 A Well, again I would say  
8 I don't know exactly how close they are. However,  
9 they, some of the factors you must take into account  
10 when you are projecting borrow requirements. For  
11 instance, if you have to replace ice rich ditch fill  
12 with select borrow or something like that, there is  
13 no way of knowing exactly how much borrow material you  
14 are going to need for those purposes until you actually  
15 open the ditch or at least do your drilling along the  
16 line.

17 So as far as giving you an  
18 actual percentage of how close we are, I simply couldn't  
19 do it. We have, as I say, projected some figures. Whether  
20 they are within 50% or 20% or 10% I am sorry. I really  
21 couldn't tell you.

22 Q Okay, what are they?

23 A I would have to look into  
24 the sufficient documents we have got. I perhaps do have  
25 something here. Yes, I do have some figures here as a  
26 matter of fact.

27 Q It is not in  
28 the volume as far as I can see.

29 A I believe,  
30 projected to date the main line requirements and again,



Bouckhout, Drew, Claridge,  
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Cross-Exam by Bayly

as I say, this does not take into account the replacement of ditch fill, is something in the order of about 18 million cubic yards.

Q Now, I was unable to find it in the application and was that because I was looking in the wrong place, or is it the document you have referred to something other than the application.

A I really don't know whether the documents I had referred to, or the documents we used to tabulate this particular information have been placed in the application. We do have spread sheets with, our alignment spread sheets on a 1 to 250,000 scale giving our various spread components.

In other words, spread 1, 2, 3 and so on and projected borrow requirements are indicated on these sheets.

Q Well, are you reading there from your own personal notes or are you reading from a report?

A Here, I am reading from my own personal notes.

Q And they are taken from the alignment sheets from the 4 mile to the inch map.

A From the spread sheets, that is right.

Q Right. Now, does that include the lateral or are you just giving me projections for the mainline?

A This particular figure



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 I just gave you as projection for the mainline, I am  
3 not aware of an exact, or any projection right now for  
4 the lateral route.

5  
6 And in speaking of the  
7 lateral route, you are speaking of the Yellowknife  
8 Pinepoint lateral system primarily.

9 Q Well, perhaps before we  
10 go to the biological considerations, or environmental  
11 considerations I could address questions to Mr. Drew  
12 who I understand is the man who has had a look at the  
13 main laterals. I'm thinking of the one to Yellowknife  
14 and to Pinepoint as being the major laterals about  
15 which you speak in your application. What sort of  
16 granular material is available along that route to  
17 fulfill the needs for the say the two laterals?

18 WITNESS DREW: Well, it appears  
19 that there is quite a lot of granular material. I wasn't  
20 studying that with borrow sites specifically in mind. I  
21 was mapping the corridor terrain wise but there is  
22 abundant gravel and sand along a good bit of the route.  
23 Mainly in the form of former lake shore deposits or  
24 abandoned strand lines if you wish to use Mollard's  
25 terminology of prehistoric Great Slave Lake.

26 And there are numerous  
27 borrow pits along the various highways there that  
28 expose a good bit of sand and gravel and I think that  
29 in most parts of that route there is going to be more  
30 borrow material available than on a good bit of the  
mainline except say the northern part of the mainline



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 up towards Richards Island where you also have an  
3 abundance of gravel and sand.

4 Q Well, Mr. Drew, one of  
5 the problems that appears to have occurred in the  
6 Yellowknife to Rae Edzo portion of the Mackenzie  
7 Highway is a lack of borrow material that has caused  
8 the road that they are trying to build there to be  
9 very difficult to complete. So far we have a mud  
10 surface on that road and from what we understand from  
11 the highway authorities, they are crying for granular  
12 material that just isn't available. Would you confirm  
13 this from your view of that particular part of the  
14 route?

15 A Well, that particular  
16 part you don't have as much sand and gravel except near  
17 Yellowknife here where we have some beautiful gravel  
18 pits just between here and the airport. I forget the  
19 exact figure but it is something like in the order of  
20 40 or 50 feet thick.

21 Q It's one of those, I  
22 believe, that is under one of the roads which has  
23 now been closed in order that the gravel can be obtained  
24 because there are shortages in the Yellowknife area for  
25 the projected needs of this community. Were you aware  
26 of that sir?

27 A No, I wasn't aware of  
28 that point from the community point of view, but there  
29 is quite a bit visible there and as you go away from  
30 Yellowknife towards Rae-Edzo you get more sand and less



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 gravel. However, if you want to start attacking the  
3 bedrock then you have got an unlimited supply.

4 Q And you would feel that  
5 it might be necessary to start attacking the bedrock,  
6 as you say, in order to get the kind of coarse material  
7 that you might need in order to complete the Yellowknife -

8  
9 A Well, that I don't know  
10 because I haven't synthesized the material or made an  
11 analysis of that. I haven't been approaching it from  
12 that view point yet but I understand that they are  
13 planning to bury the pipe even in the bedrock portions  
14 and if they bury it they are going to have to blast  
15 and take some bedrock out and that will make quite a  
16 bit of borrow material, or granular fill available.

17 Q Am I right in the Yellow-  
18 knife lateral in particular in assuming that you will  
19 be following the highway pretty closely?

20 A Not that -- I don't know  
21 what you mean by pretty closely, but it is generally  
22 north of the highway.

23 Q Yes. Well, what I mean  
24 is that you have given us a route of the lateral going  
25 from the Fort Providence area to Rae-Edzo and then  
26 turning south and coming down to Yellowknife. Now, this  
27 appears to be the same general route and I don't mean  
28 that you will necessarily be in the ditch of the highway  
29 but you will be following the same general routing?

30 A Well, from Yellowknife



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 to Rae-Edzo or Rae-Edzo to Yellowknife to use your  
3 direction, it might be. I don't have the exact figures.  
4 It might be in the order of five, ten miles from the  
5 highway in a good many places. However, from Fort  
6 Providence up to Rae-Edzo, it goes on the opposite side  
7 of I think it is Birch Lake. At times it is -- oh, I  
8 would guess maybe two or three tens of miles away from  
9 the highway. It is quite a distance anyway.

10 Q Well, would you be antici-  
11 pating competing in your needs for granular materials  
12 with that material which is required to continue the  
13 servicing and restoring of the Mackenzie Highway, because  
14 if you are only a few miles away you may be looking  
15 at the same sources?

16  
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Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

A Oh, I think

in some places we would be competing and in many  
places we wouldn't, because the pipeline isn't really  
adjacent to the highway or within sight of it in most  
cases; in some cases there probably would be competition,  
in some cases, I'm sure there's enough material for  
both.

MR. BOUCKHOUT: This is an area  
obviously that's going to have to be worked out,

Particularly in that  
location. As I say, I'm not aware of any of our gravel  
requirement projections in that particular area.

THE COMMISSIONER: I think  
they're having a luncheon or something next door and --

MR. BAYLY: So we should have  
ours?

THE COMMISSIONER: -- I think  
the Commissioner of the Northwest Territories is  
speaking there too, and --

MR. BAYLY: I hear him, Mr.  
Commissioner.

THE COMMISSIONER: It sounds  
like a familiar subject. So we'll adjourn until two.

(PROCEEDINGS ADJOURNED TO 2 P.M.)



Bouckhout, Drew, Claridge  
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Cross-Exam by Bayly

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: Go ahead,  
Mr. Bayly.

MR. BAYLY: Q Now, back to  
the subject of gravel, but let's approach it from the  
point of view of the environmental considerations,  
Mr. Bouckhout, or any other member of the panel that  
you wish to direct this question to. Have you iden-  
tified sources of gravel in terms of areas from which  
you would prefer to borrow it, either stream beds,  
upland sources, terraces, these kinds of sources?

WITNESS BOUCKHOUT: I think  
what has been done is that our engineering people have  
designated sites of borrow, potential sites of borrow.  
Now, we have said some things in terms of the fact that  
we would not take borrow from active flood plains,  
here.  
for instance, that would be one of the concerns/ Beyond that,  
once the sites are identified, our biological team  
has gone in to look at these sites, in fact this has  
been done this summer, to identify particular con-  
straints relative to such sites as have been designated  
so far in terms of denning area and so on. I think  
this is probably a question that should be directed to  
the next panel.

Q All right. Well, how do  
you define an active flood plain? What do you mean when  
you say that?

A Not being a hydrologist,  
I don't know too much about it. In my estimation an



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 active flood plain would be that area beyond the  
3 summer channel, which is regularly flooded during the  
4 spring freshet.

5 Q So, in defining it you  
6 might well be prepared to take gravel from the flood  
7 plain parts of the channel that don't have water in  
8 them at the time/<sup>that</sup>you would intend to take gravel?

9 A Well, I should perhaps  
10 <sup>on</sup>qualify/my definition a bit more. I wasn't saying  
11 that the active flood plain would have to be flooded  
12 every summer. Now I'm not sure exactly what the  
13 definition is. The hydrologists would have to give  
14 you that answer.

15 Q All right. I am expecting  
16 from you, though, Mr. Bouckhout, some sort of statement  
17 on areas that for reasons associated with your own  
18 discipline should be avoided as gravel sources. Now  
19 this, in my opinion -- and I invite you to agree  
20 with me -- has nothing to do with how a hydrologist  
21 may define it. Your concerns, as I understand it,  
22 will be concerns with regard to the environment and  
23 the things that live in it, and you will have some say  
24 in where gravel and other select material should be  
25 mined or taken.

26 A Yes, that's right, and  
27 that's the purpose for having our biologists examine  
28 designated sites, to determine whether any of these  
29 sites do have particular environmental concerns  
30 associated with them, as I've mentioned.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 to tell me who I should address this sort of question  
3 to?

4 WITNESS BOUCKHOUT: Well, I  
5 would think our biological panel, which is upcoming,  
6 would be the panel to address this type of question  
7 to, and possibly the aquatic biologist represented  
8 on that panel Mr. Worth Hayden.

9 MR. BAYLY: Well all right,  
10 I'll save those questions for Mr. Worth Hayden at this  
11 point.

12 Q Now, with regard to  
13 other sites that don't depend on your aquatic biologist  
14 there are certain upland sites that may have gravel  
15 sources that for one reason or another you may wish to  
16 avoid, and can you tell me whether you worked out a  
17 set of considerations for whether you would take gravel  
18 or other granular materials from upland sites? What  
19 would be your considerations there?

20 A We haven't, I don't  
21 think, actually gone through the exercise of working  
22 out a check sheet or a list of considerations. It's  
23 dependent on the evaluation, the on-site evaluation  
24 of the biological team who has already evaluated the  
25 potential sites that have been designated, and  
26 certainly will be involved in evaluating any other  
27 sites either alternatives or whatever.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.

Cross-Exam by Bayly

1  
2 Q Well, would it be fair to  
3 say that you haven't ruled out any particular kind of  
4 site?

5 A We have had-- Any kind  
6 of site?

7 Q That's right. Any class-  
8 ification of site. In other words, you, with the  
9 exception of saying that you will not take gravel from  
10 active flood plains, which as yet we have no definition  
11 for, you have not, at this stage, made any decision  
12 as to whether you will or will not take gravel from  
13 say river terraces, or fossil flood plains?

14 A At this stage I would think  
15 that would be quite fair to say. Of course, the whole  
16 process of designation of borrow sources is a long  
17 process which has to be attacked in various stages  
18 and I could certainly have someone on the panel describe  
19 perhaps the stages that are necessary to undertake in  
20 order to get to the final designation of borrow sites,  
21 if you would care, before, we can do that.

22 Q All right. And at the  
23 same time will this person that will be coming on the  
24 next panel be able to identify areas where you are  
25 going to have real problems getting the kind of material  
26 you need. And I refer to the north end that Mr. Drew  
27 has referred to, the Richards Island - Tuk Peninsula  
28 area where you are going to be competing with producers  
29 for gravel sources and you may have to co-operate with  
30 them to make sure that everybody gets what they need.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.

Cross-Exam by Bayly

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A I don't know that he would

be able to do that. Being a biologist, he will be

strictly concerned with the effects of extracting

borrow on the biological environment. I might point

out that something that came up this morning, from

insinuations or some comments, in fact one of our own

panel members mentioned that we might be competing, it

is certainly not Foothills intention to compete for

borrow sources with local communities. We, through our

philosophy, which has been shown through commitment to

community servicing and our response to the Fort Good

Hope situation etc., I think we have made it evident

that we are very concerned about the communities in the

valley and we certainly do not intend to compete.

Q Now, --

A If there are sources around

on the particular community which are designated as

either current needs for that community or potential

future needs in terms of expansion, I think if it came

down to a point where we had to go further afield to

get borrow sources to avoid taking it from those

particular locations, I think we would be prepared to

do so.

Q And I imagine that has

certain economical limits?

A Yes, certainly there are,

there is an economic constraint in everything you do.

If it is a matter of a trade-off, something is going to



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
~~Cross~~-Exam by Bayly

1  
2  
3 loose. Now, if it a matter of economics, it's a matter  
4 of economics and just to how far a person or a company  
5 could go; I don't know. I am certainly not an  
6 economist at all, but that's certainly an area that we  
7 would consider very seriously in view of our commitment  
8 to northern communities.

9 Q All right. And--

10 MR. SCOTT: Mr. Commissioner  
11 can I just interrupt for a moment. I am a little  
12 concerned about the leaving of too<sup>many</sup> tag ends to be dealt  
13 with in the next panel. As I understood Mr. Bayly's  
14 question originally, it was in view of your statement  
15 that there will be no gravel mining on active flood  
16 plains, will you tell me what an active flood plain is?  
17 And that was, as I understand it, deferred to a  
18 biologist on the next panel. Surely that is not a  
19 question for a biologist at all. It is a question for,  
20 well I see two people who could probably tell us on the  
21 panel.

22 MR. BAYLY: Mr. Commissioner  
23 my equivalent to Dr. Fyles has handed me a note with  
24 regard to that, that I should follow that up further  
25 and perhaps to follow that up through Mr. Drew--

26 MR. GIBBS: Are you going to  
27 be competing with Mr. Scott over who asks this question?

28 MR. SCOTT: No, I don't care  
29 if the question is not asked because we'll ask it, but  
30 presumably it is not something that can reasonably be



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3 deferred to a panel which doesn't contain a geologist  
4 or engineer or somebody. A bird or fish man isn't going  
5 to be able to tell us that.

6 WITNESS BOUCKHOUT: Mr.  
7 Commissioner, we are prepared to handle the question  
8 if Mr. Davison could speak to active flood plain.

9 THE COMMISSIONER: All right.  
10 Let's do it that way.

11 WITNESS BOUCKHOUT: Mr. Drew  
12 will do it.

13 WITNESS DREW: Yes, after  
14 several definitions of active flood plain I think the  
15 most common definition is as Mr. Bouckhout stated,  
16 a portion of the valley that is flooded when the stream  
17 is more than bank full and I think the criteria is  
18 flooding on the average of at least once a year. And  
19 then you have a fossil flood plain, or you could call  
20 it a low terrace, where the inactive part is maybe  
21 flooded once every several years. But on our alignment  
22 sheets at the flood plain, is mapped of course by a  
23 diagnostic characteristics on the air photo and usually  
24 the active flood plain in most of our routes are  
25 through country that are south of the treeline and are  
26 treed and in those areas the active flood plain  
27 generally does not support trees. While a fossil flood  
28 plain and terraces and so forth, will support trees.

29 So the active flood plain is  
30 a part that is subject to flooding often enough and



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2  
3 also being buried by a silt from stream breakup and so  
4 forth that it may support willow bushes and other  
5 water tolerant species but not trees.

6 Q Well could we understand  
7 Mr. Drew that the answer to Mr.,/the question I  
8 addressed to Mr. Bouckhout is that you will not be  
9 taking granular materials from what you have now defined  
10 as the active flood plain?

11 A I am not sure what the  
12 company policy is on that and also, as I stated in an  
13 earlier panel, our work shown on the alignment sheet  
14 is not final. It is going to be revised and is being  
15 revised as a result of field work. Perhaps eventually  
16 when the boundaries are established to our satisfaction  
17 that that will be criteria.

18 WITNESS BOUCKHOUT: That's  
19 a direct assumption by the way.

20 Q What is? Let me tell you  
21 what I understand so far that you, Mr. Bouckhout has  
22 said we won't take gravel from active flood plains.  
23 Mr. Drew has told us what an active flood plain is, but  
24 he has told me that he doesn't know what the company  
25 policy is in regards to taking gravel or other granular  
26 material from the areas he has defined. Do you agree  
27 that his definition is what you would call an active  
28 flood plain and that the company will stay out of those  
29 areas in getting out--

30 A Yes, as far as extracting



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borrow material, I believe that is the case, yes.

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Q Yes.

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2 Q What about other kinds  
3 of sites? We sort of got sidetracked at one point. Do  
4 you see river terraces, that is what perhaps Mr.  
5 Drew can tell me about if He and I understand the  
6 same thing, what I would call terraces or fossil flood  
7 plains, would you see those as sources of possible  
8 gravel mining operations?

9 WITNESS DREW: Well, fossil  
10 flood plains could perhaps be called a low terrace in  
11 Mollard's terminology. If HT is a high terrace,  
12 they're both terraces and they're both normally not  
13 flooded, though a fossil flood plain would occasionally  
14 be subject to flooding. They support trees and these  
15 do often contain good aggregate sources, although they  
16 are often covered with silt on the surface; but whether  
17 or not the company is going to use those isn't my  
18 decision.

19 WITNESS BOUCKHOUT:  
20 All right. Again the use  
21 of these particular areas is subject to evaluation  
22 by the biological team. I believe Mr. Davison has  
23 something to add to it.

24 WITNESS DAVISON: Yes, we were  
25 involved in DIAND gravel inventory in the north some  
26 years ago. This was an inventory for Richards' Island,  
27 Tuktoyaktuk Peninsula down to Fort McPherson and Arctic  
28 Red River. Our terms of reference for this study were  
29 to stay away, to not identify sources that were in  
30 active flood plains. We were not to, not identify  
potential sources within terraces, and the information



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1 as I understand, is that Foothills have used -- has  
2 been to use the DIAND information plus the Department  
3 of Public Works information in order to arrive at  
4 their potential quantities of material, or the available  
5 quantities of materials in the Mackenzie Valley.  
6

7 Q So you may identify some  
8 terrace sites provided that your biologists tell you  
9 that they are not sensitive areas for one reason or  
10 another.

11 A The background information  
12 within these reports did identify terraces as available  
13 could  
14 sources. I believe Mr. Bouckhout/explain possibly  
15 again, I believe he has explained that the identified  
16 sources have been looked at by his biological team.

17 Q Is that correct, Mr.  
18 Bouckhout?

19 WITNESS BOUCKHOUT: That is  
20 correct, yes. That's right, that was on this plain.

21 Q All right, and when you  
22 had a look of these what were the results of your  
23 appraisal of them? I gather that's from the point of  
24 view of the things that are presently living on or  
25 in these areas.

26 A Yes, that's essentially  
27 it, and we do have some recommendations from our  
28 biologists with regard to some of these borrow sources  
29 which we have designated, but these recommendations  
30 will be brought to light in our next panel, which will  
be the panel dealing with the effect on biological



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2 environments, but they have made some recommendations  
3 to stay away from some of the sites which we have  
4 designated as potential sites.

5 Q All right. Let's assume  
6 that we have a terraced site that none of your  
7 biologists are particularly concerned about because  
8 they think that the animals and plants and living  
9 there are not going to be wiped out by the taking of  
10 this material. I gather that we still have a problem  
11 for Dr. Vaartnou to revegetate these sites if that  
12 is to be done after you've taken out the granular  
13 material that you want; is that correct?

14 A We at present have not  
15 defined to what level we're going to re-vegetate actual  
16 borrow sites after they have been -- after their use  
17 is completed. This will really be a matter of deciding  
18 what potential future uses there are for the site.  
19 If it is a matter of re-using the site for further  
20 extraction of material or if it's a site which might  
21 be used for any recreational purposes and so on, The  
22 actual rehabilitation of the site, if you want to  
23 call it that, is really going to depend on the ultimate  
24 use of the site.

25 Q I'm just trying to  
26 envisage, apart from certain recreation we used  
27 to engage in in parked cars, how we use a gravel pit  
28 for recreation?

29 A Well, certainly gravel  
30 pits very close to a possible eventual Mackenzie



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2 Highway can be used either as an aesthetic opening  
3 into the forest area, or possibly as a picnic site if  
4 restored to such a degree. Perhaps Mr. Taylor could  
5 add some comments.

6 Q I wonder if Mr. Taylor  
7 had any thoughts on the gravel pit as an aesthetic  
8 opening?

9 WITNESS TAYLOR: There's a  
10 quarry on Vancouver Island that's a recreational  
11 area.

12 THE COMMISSIONER: As a matter  
13 of fact, we have a beautiful park in the centre of  
14 Vancouver that was an old quarry.

15 MR. BAYLY: I understand the  
16 Hamilton Gardens are an old quarry too, but I don't  
17 know if that's what Mr. Taylor has in mind, for  
18 re-vegetating borrow sites along the Mackenzie.

19 WITNESS TAYLOR: I think  
20 trying to duplicate the Bchart Gardens might be a  
21 bit expensive. Further to this, just as a matter of fact,  
22 we are doing, in co-operation with the Department of  
23 Public Works now in Revelstoke, which falls within  
24 a National Park, a reclaimed gravel pit as a recrea-  
25 tion area. Primarily it will be utilized for picnic-  
26 ing.

27 Q All right, now one of  
28 the prime considerations, as I understand, for turning  
29 a gravel pit or a rock quarry into something other  
30 than a gravel pit or a rock quarry is money, and at



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1  
2 some point I gather Foothills will just have to decide  
3 where best to spend its money and that some of the  
4 things you can do to either restore or rebeautify a  
5 gravel pit or a quarry are more expensive than they  
6 are worth. Would that be fair to say, Mr. Bouckhout?  
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WITNESS BOUCKHOUT: A Well,

I think that would have to be qualified according to  
who was trying to determine what they are worth.

That is certainly the case.  
restoration of a gravel pit is obviously going to cost  
more than just leaving it the way it is and restoration  
entails things like re-contouring the slopes, perhaps  
re-vegetation and things like this and it is really a  
matter of final design to project what the ultimate use  
these various pits could potentially be and apply a  
design or a restoration design to that particular pit  
as relative to what its ultimate end use could be.

I am not trying to suggest  
that we are going to re-vegetate every gravel pit, every  
borrow pit that we happen to dig because there is some-  
thing in the order of over a hundred of them so certainly  
we wouldn't be doing this. It is a matter really of  
selection of those particular pits which have potential  
for further end use.

Q Right. Well, unless I  
misunderstood the evidence that Arctic Gas gave, their  
prime consideration in restoring a gravel pit or a  
quarry was a question of making sure that erosion  
problems didn't get out of hand and turn the site into  
a real mess. They were looking at stabilization rather  
than beautification as their prime objective in restora-  
tion. Would you say that Foothills is really looking  
at that as the prime consideration?



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2 A I would say, I don't know  
3 if we could say it is the--It is a prime consideration  
4 obviously. As far as restoration of a pit is concerned,  
5 re-contouring to stable side slopes is not as expensive  
6 as re-contouring to something beyond that plus re-  
7 vegetation over and above that. So certainly that would  
8 be a consideration in how we leave the individual pits.

9 Q So, is it fair to say  
10 you don't really know what you are going to do with  
11 individual pits, but that some that might be close to  
12 areas that people will normally see may get a more  
13 luxurious treatment than others?

14 A That's true. I think it  
15 is very true to say we don't know exactly what we're  
16 going to do with each individual pit because, in fact,  
17 we're not at that stage as yet. That's a final design  
18 matter. Even the selection of each individual pit is  
19 really a final design matter. It's just a matter now of  
20 identifying what the sources are along the route and  
21 what some of our requirements would be and projecting  
22 beyond that, again to the several levels toward final  
23 design.

24 Q Well, maybe Mr. Taylor  
25 will want to say something about that. But is it really  
26 the test of accessibility by people that will determine  
27 whether you do a fancy restoration or a stabilization  
28 restoration?

29 WITNESS TAYLOR: A I  
30 think it's a matter of both physical accessibility and



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visual accessibility. If the particular location is  
near a highway or other types of land uses / <sup>that</sup> might  
be sensitive to this kind of a process such as a park.

It probably would be  
in order to use provisions that would adequately restrict  
this. In other words, attempt to return it to its  
something approaching its former appearance.

Q Well, Mr. Taylor, we've  
heard from Miss Minning that whatever you do unless you  
take it from an active flood plain of a braided channel  
stream, you're going to have a hole, because you've taken  
out more than you can possibly put back in without  
making another hole.

A Well, that's true. I was  
thinking in terms of re-vegetation, trying to relieve  
the effect of the scar.

Q All right. Now, Dr.  
Vaartnou, re-vegetating gravel pits I understand  
presents some problems, one because you are often dealing  
with granular materials on which grasses take less  
readily than the materials that hold moisture more  
easily and you may be dealing with areas at the bottom  
of those pits that get flooded regularly and drown out  
some of the species you may be trying to put back. Are  
those considerations which you have to take into account?

WITNESS VAARTNOU: A Yes.  
Perhaps I have to consider what should <sup>be taken</sup> into account at first  
my approach to that type of rehabilitation, not re-  
vegetation. Re-vegetation has to fit in to match the



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2 need of the rehabilitation and in case if the gravel  
3 pit should be rehabilitated to contain water, it means  
4 that area we don't need to re-vegetate.

5 If the contouring has to  
6 be made such that the gravel pit is not the square  
7 box, it has to be done so that <sup>it is</sup> aesthetically  
8 acceptable. And again the planting re-vegetation should  
9 be done according to what material is available.

10 And these plant material,  
11 I don't mean the grass. I expect to use the native  
12 shrubs as much as possible. Native legumes, native  
13 grass and all those should provide the self-supporting  
14 ecosystems. If necessary, we could use and put back some  
15 final material to make the place habitable to the  
16 plants that we have tried to use there.

17 Q So your prime considera-  
18 tion would be to make sure that you didn't have bad  
19 erosion problems and after that your secondary consid-  
20 eration would be to make the pit visually more acceptable  
21 to people who would be using it for various things?

22 A That's correct.  
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Q Now, we heard evidence

from Mr. Dabbs from Arctic Gas with regard to re-  
vegetation and one of the methods that he talked  
about using was reseeding from helicopters using a  
mixture of fertilizer and seed flown at approximately  
100 feet for the purpose of reseeding the right-of-way.  
Is that a method that you would contemplate using,  
sir?

A

Yes, except

the height. I cannot see some grass seeds that's  
very light, the calamagrostis canadensis or meadow foxtail.

If you try to spread them 100 feet at all the ground,  
I think you would spread them out 500 feet or more.  
So as much as I could see it, my plan is to fly the  
helicopter approximity of 40 feet.

Q 40 feet?

A Yes, when I want to go,

and besides that we try to develop the methods,  
develop the seed to make it heavier to hit the ground,  
and the contact with the side and therefore try to  
get the better rooting possibility for germinating  
the ability of the grass seed.

Q How do you weight this,

sir? How do you weight the seed to make it  
heavier? Do you coat it with something?

A Yes. The method says

some glue has to be used, and maybe some  
material like some dust materials to be used, except



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method for using grass seed for that purpose is  
not available yet, but we're working and it would be  
available in time when it comes.

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Q So this is something  
that hasn't been developed but would have to be  
developed if you were to use this system of seeding  
the lighter grass seed?

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A Yes, it's used, the  
method is used, but some other type of materials and  
the fertilizers <sup>usually</sup> / are pelleted.

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Q All right.

A And pelleting method

is used for apply the bacteria to the legume seed, but  
required to make it available because it's not on that  
soil expected to be existing there.

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Q Is that sort of like  
dropping each seed in a little pea pod or something  
like that?

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A Not exactly but rolling  
effect, so you had to roll the seed so you could coat it.  
Maybe not each seed into a seed bag or group of seeds,  
depends what size the pellet you want, what kind of  
soil you want to use it and what seeds you're going  
to use it.

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Q All right. You're flying  
at 40 feet. And the photograph that we saw that Mr. Dabbs  
showed us on the screen, and you weren't here so I'll  
describe it to you, was of a helicopter at about 100  
feet with a bucket in which the seed and fertilizer



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1  
2 were contained which could be controlled from the  
3 cockpit of the helicopter which was hanging some  
4 feet below that. I couldn't tell from the photograph  
5 just how far below. Would you plan to have your  
6 helicopter at 40 feet and your bucket below that?

7 A No, the bucket would be  
8 40 feet.

9 Q I see, so your helicopter  
10 could be higher than 40, except that your seed would  
11 have to be at around 40 feet to be excreted.

12 A Not higher when it drops  
13 down.

14 Q Well, would this method  
15 be designed to re-vegetate only the disturbed area,  
16 that is the berm, the area that the pipe will be put  
17 in, or is this designed to put seed on the whole of  
18 the right-of-way, the 120 feet that would have been  
19 used for construction?

20 A When -- if it's needed  
21 over all the right-of-way, but I cannot visualize at  
22 120 feet width of right-of-way that all is needed, I  
23 expect that there should be some native material still  
24 alive and I expect to use that method, yes, where is  
25 needed on the pipeline.

26 Q Now what season of the  
27 year would you contemplate this seeding being done,  
28 sir?

29 A I would like to do it as  
30 soon as possible because you get the seed into the



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2 ground if the ground is disturbed. If you wait until  
3 there is snow cover going to be smooth and seal up the  
4 surface, your chances to get the seed into the ground  
5 is much less.

6 Q Would you run into  
7 problems with the seed blowing away if the ground was  
8 too smooth?

9 A Yes.

10 Q That is the snow cover  
11 was too smoth.

12 A Yes, that's exactly what  
13 can happen because there's windy areas, very windy and  
14 that's the reason I would like to do it as soon as  
15 possible after finishing the construction of the other  
16 part.

17 Q Well, assuming that you  
18 may have to put some seed, not just where the pipe  
19 goes but on the working pad beside the pipe, would  
20 you contemplate roughing that surface up somehow prior  
21 to completing the job so that the seed wouldn't blow  
22 away?

23 A Yes, if it's too smooth,  
24 yes, it has to be; not only <sup>the</sup> blowing away but it is  
25 necessary, if possible, to cover the seed someway.  
26 If you leave it on the surface it very easily would  
27 be dried out and germination would be lost or the  
28 plants, seedlings, would be killed and that's the reason  
29 I would like to get it into the surface, if we used  
30 the aerial seeding we expect that we get some snow



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2 cover after that would force the seed into the ground,  
3 and then when the springtime comes and the ground is  
4 going to be melted out, it means there would be cracks  
5 and it/<sup>really</sup>could go down and provide a proper media for  
6 germination of the seed.

7 Q All right. Now, there are  
8 going to be some areas, according to the application,  
9 where the amount of possibly disturbed ground will be  
10 the width of the right-of-way plus 200 feet and I'm  
11 thinking specifically of river crossing areas where a  
12 large area may have to be cleared to get in the equip-  
13 ment to put the pipe under the river. Would you contem-  
14 plate seeding that by helicopter, or would you contemp-  
15 late seeding that kind of area by using people or  
16 machinery on the ground?

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Taylor, Reeves.  
Cross-Exam by Bayly

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3 A I think at first we would  
4 fly it over anyway with helicopter but I could visualize  
5 some areas there where the aerial seeding would not  
6 be successful and in those areas, specifically with very  
7 light sandy areas, we had to get the seed cover and on  
8 those areas if possible, I would like to use the ground  
9 equipment one way or the other way. Like Brillion  
10 seeder type or some harrows or just some rollers. Get  
11 a light roller to get the seed into the ground  
12 and some areas there, seeding would not be enough. We  
13 have to use some vegetative material to get it in,  
14 shredded material or if there is moisture enough,  
15 cuttings, rooted or unrooted. But I cannot visualize  
16 in some areas with very light sandy slopes, that salix  
17 or willows would be the proper plants to be used and  
18 of those areas I would like to use <sup>like</sup> alder, established  
19 from the seeds because as much as I know, nobody has  
20 been able to successfully root the stems, stem cuttings  
21 yet.

22 They could yes indicate some  
23 growth but they would not serve unnormally under these  
24 conditions and willows on the sandy slope, high, dry  
25 sandy areas is not the species. But definitely I am  
26 going to use other shrubs like shepherdiae or--

27 MR. BAYLY: What is that one?

28 A That's, I guess it's--  
29 And then other ones like vacciniums; not all of them  
30 are blueberries. Some vacciniums are cranberries, some



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Taylor, Reeves.

Cross-Exam by Bayly

vacciniums are loganberries and I definitely think in  
terms of loganberries here, vaccinium vitis-itea

MR. BAYLY: Before you go on  
that word has escaped me and probably the court  
reporter. Do you think you could spell that sir because  
she has to put that down on the record.

A V-A-C-C-I-N-I-U-M-S.  
V-I-T-I-S-I-T-E-A.

Q Thank you sir. Now, I  
heard  
have you talk about rollers and about harrows and when  
I visualize work done with rollers and harrows I  
visualize no snow cover and a certain amount of the  
ground being thawed out so that this machinery can be  
used. Are you thinking of the kind of machinery that  
I wouldn't say see on a farm somewhere prior to seeding  
time?

A Yes, you have visualized  
a rototiller?

Q Yes.

A I guess roller you could  
visualize?

Q Yes.

A Harrows?

Q Yes. I can visualize these  
but what I am having trouble visualizing is using these  
machines when the ground is frozen and when there is  
some snow cover and that is what I had interpreted from  
your explanation of as soon as possible in terms of when



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Taylor, Reeves.

Cross-Exam by Bayly

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you want it to do your seeding.

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A I don't expect to be very  
deep snow cover, right after the snow is worked up there.

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Q All right. Now, how do  
you use a rototiller in frozen ground?

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A Yes, you have to use  
weight and you don't penetrate very deep and that's  
exactly what I want. I don't want to go too deep.  
I want to stay half inches on the surface if possible.  
Because for seeding points of view, if you make the  
surface too loose, the seeds will usually dry out  
there. But if you just prepare the surface so you  
could cover the seed, you get 90% better success.

16

17

Q So all you are really doing  
is scuffing up the surface?

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A That's it exactly.

21

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Q All right. And you think  
that can be done even on the frozen ground?

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A Yes.

Q How big a rototiller is  
that?

A It doesn't need to be big.  
It's weight that counts. Heavy. And proper knives or  
blades. Not the weight. The smaller do better <sup>work</sup> /than  
the large ones.

28

29

30

Q All right but you wouldn't  
contemplate using a caterpillar tractor with those  
teeth that <sup>they</sup> /drag along behind them?



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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2

3

A No. Not for that purpose

4

Q That would make too deep

5

a cut in your estimation?

6

A You could get deeper cuts,

7

you could get it in, but it is much harder. It is not

8

necessary. It leaves the surface too rough.

9

Q Now, how about these rollers

10

for pressing the seed in. Are they something like the

11

garden rollers that we would see people working on

12

their lawns with?

13

A I would expect that they

14

would be quite a bit heavier because your working on

15

frozen ground and that is the reason you would need

16

quite a bit heavier roller.

17

Q And what would it be

18

pulled by? A large piece of heavy equipment?

19

A A small caterpillar.

20

Q All right. A small

21

caterpillar at this stage would also be doing some of

22

the scuffing to the ground?

23

A That's right.

24

Q Right. Where does the seed

25

fit in? Somewhere in between these two?

26

A The seeds would be planted

27

before this.

28

Q All right so you put your

29

seed in --

30

A You put your seed in and



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
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then you go over with the machinery and get the seed  
compact to the soil.

5

6

Q And you seed before you  
rototill?

7

A Yes.

8

Q Not, after?

9

A No.

10

11

12

Q Right. Now, you would be  
using fertilizer although not nearly as much fertilizer  
as Arctic Gas wants to use.

13

14

15

16

17

18

19

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22

23

24

A Yes, I don't know exactly  
how much <sup>is</sup> here but I could visualize it in some areas  
where the soil is fertile enough to support, like some  
of these mixed foods for forest areas. I just  
question the rationality to use any fertilizer there.  
Some other areas, as I mentioned, I could visualize  
what is poor like tailing sand with no nutrition  
at all. We could use maybe the same amount as Arctic  
Gas uses, but average I could visualize that it is not  
necessary because I am not looking at luxurious growth.  
I am looking to establish the plants that are able  
to survive in natural conditions.

25

Q All right.

26

27

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Bouckhout, Drow, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 Q How long will this  
3 process take to re-vegetate? You want to establish some  
4 plants which will be able to take care of their own  
5 recolonization along the right-of-way.

6 A Yes.

7 Q Now, how many years would  
8 you say it would take before the right-of-way had  
9 managed to re-vegetate?

10 A I could visualize it  
11 that the areas where we are going to use the shredded  
12 native shrubs that the area should be properly covered  
13 within two or three years because first year the second  
14 year would be so nice to have reasonable cover with  
15 grass and at the same time we expect the shredded  
16 material would be established in the first year.  
17 Second year you could visualize that it would be quite  
18 young plants usually growing, they are not any more  
19 old grasses coming from established community. They  
20 would be rejuvenated and second year I expect them  
21 to grow properly and start to fill in the year again,  
22 third year and fourth year I expect it would be near  
23 the natural state, except there would still be some  
24 grass seed in that.

25 Q All right. Now, I assume  
26 this takes into account the fact that in some areas  
27 the native diseases to the native plants will kill some  
28 of them.

29 A Usually the native disease  
30 don't kill the native plants. They kill introduced  
plants.



Bouchhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
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1

2

Q I see, well --

3

A Because they normally are

4

resistant to that local native diseases.

5

Q I see, well how do

6

local native diseases exist if all the local native

7

plants are resistant to them?

8

A Yes. They exist there

9

but they are part of that local community. It does not

10

mean / <sup>that</sup> one plant disease is plant two, as funguses usually

11

or bacteria.

12

Q So these --

13

A They could live together

14

with prior competitive conditions.

15

Q All right, so they'll have

16

built up some resistance to these because they are nat-

17

ive species.

18

A Yes.

19

Q But there will still be

20

some that are killed by them because the diseases

21

exist.

22

A Oh yes. Yes always

23

prior competitive conditions there.

24

Q Now we've heard from

25

other witnesses in this Inquiry that the right-of-way,

26

because it will cause what I believe are what are

27

called edge effects, that is we will have bush and

28

then an open clearing, and then bush again, that

29

animals and birds like to congregate at these edges

30

for the purpose of feeding. They have the protection



Bouckhout, Drew, Claridge  
Davison, ~~Vaartnou~~, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 of the forest on the one side, and they have an  
3 open clearing where young tender plants live, or  
4 perhaps there's an abundance of seed that's easy  
5 to get at exists. Do you contemplate that some of your  
6 re-vegetation scheme will be thwarted by animals and  
7 birds which are attracted to the area that you have  
8 recently seeded?

9 A Yes, possibly. We try  
10 to avoid as much as possible the invitation of a  
11 native animal to the right-of-way. If we use very  
12 luxurious growth there, it means this growth itself  
13 would invite the native animals there. If we use  
14 that grass like as I mentioned *festuca saximontana*  
15 in the pictures, well top growth --

16 Q Which one was that?

17 A *Festuca saximontana*  
18 one of the native fescues, this grass, the  
19 growth is so limited and it would be dormant most of  
20 the year, only two, three months in summer when it's  
21 green, and really there isn't very much food for  
22 native animals.

23 Q So you're saying that  
24 the animals would probably prefer Kentucky bluegrass  
25 to the native species that you would be re-introducing.

26 A Definitely so.

27 Q But there would be this  
28 effect that you might find a larger concentration of  
29 animals and birds in a cleared right-of-way than  
30 you might normally find in a forest.



Bouckhout, Drew, Claridge  
 Davison, Vaartnou, Lawrence  
 Taylor, Reeves  
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A Yes, I expect the  
 trampling effect would be more serious than eating.

Q All right. Now, in order  
 to ensure the success of your reseedling project,  
 will it be necessary for you to sort of post

"Keep off the grass"  
 I don't mean that  
 signs along the right-of-way?/in the sub-division  
 kind of concept, but will you be making attempts to  
 keep people from using the right-of-way until your  
 program has been able to catch?

A No, because if we can't  
 do any better to keep animals and people out, we  
 don't use the right material.

Q So your scheme has  
 taken into account that there will be some killed  
 because of animals, people, or whatever?

A Oh yes. But mostly I  
 would concentrate on creeping materials, creeping  
 plants, rhizomatous plants, creeping onto the --

Q What was that word  
 before plants?

A

Q

A

under-ground runners, underground stems.

Q R-I-S-O-M-E-S?

A R-H-I-O

WITNESS BOUCKHOUT: Like  
 water lilies, for instance. They extend under water,



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 the stems actually rise up.

3 Q Yes, I see. Are there  
4 others, or are we contemplating quite a lot of this  
5 right-of-way being underwater?

6 WITNESS VAARTNOU: There is  
7 like Kentucky bluegrass.

8 Q Which I gather is not  
9 a native specie.

10 A Oh, they come on,  
11 Kentucky bluegrass is native there, but we definitely  
12 would like to use native Kentucky bluegrass there.  
13 But it starts growing much faster than nugget Kentucky  
14 bluegrass, and my variety selected there and in the  
15 spring there is indicated a two weeks earlier growth.

16 Q Now, one of the problems  
17 that Arctic Gas admitted that they had through their  
18 witness, Mr. Dabbs, was that they just couldn't get  
19 enough seed to reseed with native species. Can you  
20 explain why you have been able to corner the market  
21 so successfully?

22 A No, I can't believe  
23 their own words, I had to go back to Dr. Younkin's  
24 Report where he indicates that he could grow 900,000  
25 pound of Arctared in six years.

26 Q And now --

27 A So how they can grow it?  
28 It means they have to start from the beginning.

29 Q They haven't started,  
30 you would say?



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
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A But they should have,  
as much as I know the type. How they can grow it,  
I don't know. Two years ago I guess I discussed with  
Mr. Dabbs and Dr. Younkin in March, 1974, and I indicated  
that they would have problems trying to grow it below  
High Level and that time I was the skeptic. They was  
very, very -- I mean they thought that there was no  
problem. Now I guess we have little bit reversed the  
situation. Meantime I had the ecotypes that I can  
produce seed, yes, not as much as I would like but  
enough instead of 300 pounds per acre, I would grow  
maybe 75 or 100 pounds per acre. That is good enough.

Q And you have to grow  
that north of High Level, you say, to be successful?

A There are certain  
ecotypes, yes. Some can be grown south, but I don't  
intend to grow anything out of this, that snow mould  
zone that I mentioned before noon, the borialis fungus  
that means I don't want to grow any seed below 60 or  
55 latitude.

Q I see.

A Everything should be  
grown within that zone because that's the disease what  
I'm more worried than anything else.

Q So you feel that if you  
don't grow them north of the 55th Parallel latitude  
that they may be susceptible to this fungus that  
killed off so many of the plants that you showed in  
your photograph.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 A Yes The reason is with  
3 cross-pollinated plants there's a variability there  
4 in any species so you could select and I expect, when  
5 in time, when I grow the seed that nature reduce the  
6 susceptible clones or plants out that and would be  
7 only resistant to that disease, would be produced a  
8 seed for me.

9 Q Now, you've given some  
10 interesting figures, sir, on growth rates, and if I  
11 can refer to those, on page 34, the bottom of 34 and  
12 35 in answer to question 20 in your prepared evidence  
13 you say that there will be enough seed to re-vegetate  
14 1,000 acres by 1978, 3,000<sup>acres</sup>/by 1979, and virtually  
15 unlimited quantities by 1980 and thereafter, and  
16 I can understand your geometric regression up to the  
17 3,000 acres by 1979, but what does "unlimited quantities  
18 by 1980" mean? Do we suddenly have a population  
19 explosion of seeds that allows you to re-vegetate  
20 hundreds of thousands of acres, or what does that mean?

21 A Could I illustrate how  
22 much seed is needed to plant one acre for seed produc-  
23 tion?

24 Q Yes please.

25 A Consider that there is  
26 -- O.K., we start with smallest agrostis, I guess it's  
27 proposed to be used somewhere too. Approximately six  
28 million seed per pound, we need approximately 15,000  
29 plants per acre to grow the seed. I think if we use  
30 .1 pounds per acre as it's quite normal with that type



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 of seed to plant an acre. We could, if we that and  
3 you see .1 produces ten times more than is needed,  
4 so if we have -- to make simple, right now we have  
5 one pound of specific ecotypes <sup>agrostis</sup> that's available  
6 for seeding next spring.  
7  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 of the actual re-vegetation program. In order to  
3 reseed the right-of-way with the species that you want  
4 to use, I am assuming that you will want to overplant  
5 to a certain extent, because you're planting perhaps not  
6 at the ideal time or under ideal conditions. This isn't  
7 a nursery that we're reseeding. This is a frozen right-  
8 of-way where you have to use heavy equipment to pull  
9 rollers and you are going to lose some seed because  
10 you have created an environment where the early birds  
11 are going to -- the early returning birds are going to  
12 try and eat some of the seed so is your figure of .1  
13 pound per acre the amount that you envisage for the  
14 right-of-way, or would you put more on it?

15 A No, the right-of-way as  
16 I tried to specify. If you, say take arctagrostis.  
17 I specified one pound arctagrostis per acre. Total  
18 seed on the northern area as I specified is approximately  
19 25 -- all the species together.

20 Q So you are taking a  
21 multiplier of the amount you would use in your test  
22 facility north of High Level and you are increasing it  
23 as you go north because of the possibilities of kill  
24 and loss through eating or blowing away?

25 A Yes. Not exactly, because  
26 I plan to use vegetated propagation on all tundra areas.  
27 And in seeding would be additional to the vegetative  
28 native material. I expect that the re-vegetation should  
29 be done in tundra areas on native shrubs, locally  
30 available and right now we are doing testing at this



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 time when we should do it. We know that we could do  
3 it in the spring and wintertime taking it, but could we  
4 do it in the fall also?

5 What maturity based is  
6 with the test? We know that hardwood cuttings we  
7 always could do it but could we do it in any other time  
8 of the season?

9 We are testing if we  
10 are trying to find the best time, best methods, how to  
11 handle it. We know that if we use it we would say a  
12 rototiller to harvest that material. Now, it  
13 depends what kind of species it is going to be. It  
14 would be two or three inches chunks there, including the  
15 vegetative material and some of the soil we are planning  
16 to keep approximately two to four inches soil together  
17 with the vegetative material. So in time when it comes  
18 in the spring the species -- the vegetative species --  
19 would be some way covered with soil, but we never want  
20 them to put underneath of the six inches of soil layer.

21 We know that we could kill  
22 them. There would be nothing left.

23 Q So you have got to place  
24 them under a shallow amount of soil?

25 A That is right.

26 Q Or I presume the tundra  
27 mat when it is placed back shredded will be thinly  
28 covered over this area?

29 A I don't expect the tundra  
30 mat. I expect a vegetative material from the tundra



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 to be used for that one.

3 Q Yes, well I --

4 A If we try to mix that  
5 one with six inches of the soil I am sure we can  
6 all the material except for only a few that could  
7 survive.

8 But I would like to  
9 put the vegetative material on the material that is  
10 used for backfilling<sup>of</sup> the ditch and incorporate it  
11 there using rollers, or if necessary rototillers. But  
12 I expect a roller would be the best. If not smooth  
13 rollers but the spike roller types would be the best  
14 to incorporate into that surface.

15 In that case, we do not  
16 create a separate layer there. We plant that part of  
17 plant material into the backfill ditch line.

18 Q Right. Now, you have  
19 talked, sir, about test areas. Have you got areas  
20 similar to the ones that Mr. Dabbs described in the  
21 Northwest Territories (for example, on Richards Island  
22 or the Tuk Peninsula) where you will be experimenting  
23 with some of these techniques prior to receiving per-  
24 mission to build your facility and re-vegetate?

25 A My advice to the Foothills  
26 is that we get something to start next spring with  
27 this winter would be prepared and actual tests would be  
28 carried out starting next spring -- three years' tests.

29 We have the sites enough  
30 to Yellowknife and we have lots of them in lower



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 elevation, but for Foothills purpose I would like to  
3 have this site in Canadian Shield area. Some in Norman  
4 Wells area and some in the treeless tundra area.

5 Q All right. So you are  
6 talking about a three-year program starting at the  
7 end of this winter?

8 A Yes.

9 Q Right. And that will be  
10 the real test of the theory to make sure that what you  
11 have discovered, at your test site north of High Level  
12 actually works in a practical pipeline building type  
13 of a situation?

14 A Yes and one thing that I  
15 definitely would like to test our competitive ability  
16 of methods that I am using. To me, mono-culture  
17 as tested normally --

18 Q What was that?

19 A Mono-culture -- single species  
20 tested itself. It is for that purpose it is useless.

21 Q So, putting the species  
22 in together in a plant community to you is far more  
23 important than testing a single species?

24 A That's correct.

25 Q And that would be part of  
26 your three-year test program?

27 A That's correct.

28 Q There is only one other  
29 question that I would like to ask you in this area.  
30 And that is with regard to the problem that could



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

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occur if for some reason your seeding program failed.

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And what I am thinking

of is the possibility say of a forest fire or a tundra  
fire that would devastate an area of your reseeded '  
material say within the first five years of from the  
first time that you began reseeding. Would you be  
reserving enough seed for that and are there problems  
with reseeding an area that has been burned over?

A If/ <sup>there's</sup> enough loose

material on the surface that it would not be a problem  
to reseed it but if the surface is hard it would be  
very very hard to try to establish the new seedlings.  
So it means that that case the surface should be  
loosened to get a better establishment.

I expect the seed now  
on would be available in the future any time.

Q So you would be keeping  
in reserve, excuse me, enough seed in case some event  
happened in one area or more that would cause the  
necessity for re-vegetating?



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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A

At the

4

present time Foothills is promoting that seed growing

5

but I expect that it would be economically more

6

reasonable to carry it on and make it available in all

7

of the northern developments.

8

Q

All right. Now,

9

some plants grow better after fires than others. Isn't

10

that true for example, blueberries grow better and

11

jack pine regenerates after a fire because the cones

12

need the heat to open generally? Will you have trouble

13

with your re-vegetation plans because either ash has

14

been introduced into the soil or because other species

15

have started to invade the area that normally wouldn't

16

have, had there been no fire?

17

A Well there are two examples

18

They have you mentioned. /completely different reasons. Jack

19

pine you need the heat to open the cones and get the

20

seed into the ground. Blueberries, you reduce the

21

competition from other species and that is the reason

22

they are expanding and they are able to come back from

23

their roots. As itself, it is the best material to

24

establish a good seed germination media/to plant it if there is

25

enough loose material. But as itself, it is the best

26

fertilizer what you could apply.

27

Q Well, in that case and since

28

it appears that from both your plans and those of

29

Arctic Gas, a large amount of the brush would be burned

30

on the right-of-way, would you advise taking that ash



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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3 and spreading it over the area to be reseeded prior  
4 to reseeding?

5 A Yes, if it is done any  
6 other way, it is just waste and that to me is criminal  
7 to use it in another way.

8 Q So, you would advise rather  
9 than just burning on a single site, perhaps burning on  
10 a sled that could be moved down the right-of-way  
11 spreading the ash as it went?

12 A Well, one way or the other  
13 it has to be spread and specifically where we want  
14 to plant and use the seed.

15 Q Would you advocate saving  
16 ash from certain burning sites and transporting them  
17 to areas where you might anticipate more difficulty  
18 seeding than in others?

19 A It is a good practice but  
20 economics comes into the question there.

21 Q All right but you would  
22 advice that if economics allowed it?

23 A Yes, I would be most happy  
24 if I could use it.

25 Q Yes.

26 THE COMMISSIONER: Well maybe  
27 Mr. Bayly this would be a good time to stop for coffee?

28 MR. BAYLY: Yes, sir.

29 (PROCEEDINGS ADJOURNED TO 2 P.M.)  
30



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

Q Dr. Vaartnou, before we  
leave the subject of reseeding, I have been thinking  
over my questioning and I don't think we have from you  
the month when the reseeding would likely take place.  
I know you want to do it as soon as possible after the  
construction has been completed and I presume the  
cleanup operation, but have you determined and  
recommended to Arctic Gas when this should be done for  
the various climatic areas of the right-of-way?

MR. GIBBS: I hope he hasn't  
been recommending to Arctic Gas.

Q I am sorry. Sorry to  
Foothills although I should be forgiven Mr. Commissioner  
I see we have a consultant to both on this panel.

THE COMMISSIONER: Your not  
suggesting that there is a conflict of interest there?

WITNESS VAARTNOU: In both  
cases, no.

Q And if you have not re-  
commended one, have you thought as to when the best  
month for the various areas would be for the species  
that you are planting? Some of them I gather may be  
different. It may be better to plant one grass just  
before the snow grows and you may have a better chance  
of survival with another one if you don't plant it until  
a bit later.

A Usually grass is like



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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2  
3 Kentucky bluegrass that has this grown-in inhibiting  
4 factor. They would like to have some moisture before  
5 they would germinate. Other grasses like fescues  
6 or agrostis don't mind. They don't have that  
7 inside inhibiting factor and it is not necessary the  
8 moisture conditions, but like Kentucky bluegrass,  
9 yes, snow affect would be very good.

10 Q All right. Are there any  
11 of the grasses that would have to be seeded in the fall  
12 following the first, following the construction? Would  
13 you have to wait over the summer and plant it in the  
14 fall?

15 A Yes, there is one that I  
16 described, hierochloe, a wheat grass.

17 Q Yes and that would have to  
18 be planted in the fall?

19 A Not necessarily but if you  
20 plant it in the spring, it takes maybe a year before  
21 it germinates because the dormancy requirement  
22 and cold treatment is necessary for the funnelization  
23 process which means if you plant in the spring, it would  
24 germinate next year or the year after.

25  
26  
27  
28  
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Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 Q So, it might be advisable  
3 to do the planting of that grass along with some  
4 reconnaissance work that you would be doing on the  
5 right-of-way to see how the grasses were coming in  
6 the fall after the first planting?

7 A No, but you shouldn't  
8 plant it before the area is finished of construction  
9 point of view. It means if using that species it  
10 comes up later and could fill in later on.

11 Q I see.

12 A The same, quite a few  
13 of the native shrubs have a dormancy requirement and  
14 if you use the seeds of native shrubs you can't expect  
15 them to come up first year. They might come up second  
16 year or third year, but you have to put the seed in  
17 in time when the construction is finished because  
18 otherwise you never get it into the ground.

19 Q So you would contemplate  
20 seeding everything at the same time but some things  
21 would come up a year or two following the seeding.

22 A That's correct.

23 Q And what about surveillance  
24 Would there be a need for a certain amount of overflying  
25 of this right-of-way to see how your program is coming  
26 along in the summers subsequent to the seeding?

27 A Yes. First summer is  
28 very important on that point of view, and should be  
29 done.

30 Q How many flights would



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you contemplate per month, for example, to check this  
out, the progress of the seed?

3

4

A Twice in the summer.

5

6

Q And how long would you  
wait after the seeding before going the first time?

7

8

A At least three or four  
weeks. That is not critical, you could do it any time  
later on in summer. But you don't expect the seeds  
to be up and you can't see very much first month after  
the spring thaw.

11

12

13

Q All right, so this would  
be three or four weeks after the snow had all gone?

14

15

A Yes, after the seeds  
germinated.

16

17

Q All right, and the seed  
can't germinate until the snow's gone.

18

19

A Say two or three weeks  
after the snow is gone, and then another three to four  
weeks the first surveillance.

20

21

22

Q Would it be fair to say  
that that would be somewhere around the middle of the  
summer?

23

24

25

A Somewhere, yes, but I  
don't - I can't be specific, I can't put my fingers  
on it.

26

27

28

Q You can't put a month on  
it because summer comes at different times on differen  
parts of the right-of-way.

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A That's correct.



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Q The second visit, would it be just a few weeks after that, or would it be prior to snowfall, or what would you contemplate?

A The last visit I would like to be carried out before snow comes, then we can evaluate the growth and then we can expect next spring what is necessary.

Q So some of that might begin on the northern end as early as August and in the southern end it might wait until September or perhaps even early October.

A That's correct.

Q Now, if we could turn to the problems associated with sources of water. Now, we've heard from you, Mr. Lawrence, about certain water storage plans and what I'd like you to tell me is at what stage you and therefore Foothills are at concerning water sources, both for construction and operation and maintenance of the facility?

WITNESS LAWRENCE: Neither group have done really site specific studies to date. We have had preliminary looks at the route in each case and have not been really concerned as regards a detailed source for each construction site.

Q All right, and is it true that you have done these as office studies rather than reconnaissance on individual lakes and rivers?

A I can't say we have really done a study. This has been something we have



Bouckhout, Drew, Claridge  
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2 done on our own, out of our own curiosity to satisfy  
3 ourselves that there is very, very few sites along  
4 the pipeline that are not within economic hauling  
5 distance for water.

6 Q And have you done air  
7 photo examination of the route?

8 A Cursory, yes.

9 Q When you say "cursory",  
10 what does that mean to you?

11 A That means that I've  
12 satisfied my curiosity by looking at the pipeline  
13 sheets to see that each compressor station, which are  
14 generally going to be the main construction sites,  
15 are not too far from sources of water.

16 Q All right. Now when you  
17 say --

18 A I've also examined  
19 the maps that you see behind you, and satisfied our-  
20 selves again that there may be one or two sites that  
21 are fair distance from a water supply.

22 Q Now, what has to be  
23 done, I assume, after you have satisfied yourselves  
24 that the compressor stations aren't very far from a  
25 source of water is to determine whether they're very  
26 far from a usable source of water; is that correct?

27 A That is correct.

28 Q And usable has something  
29 to do with water quality, but it also has to do with  
30 other uses of the water by either other people or by



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other members of the animal or plant kingdom?

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A That is correct.

4

Q And that's an examination

5

I take it your firm will be doing for Foothills, is

6

that correct?

7

A That's correct.

8

Q And when will that start?

9

A We're given to understand

10

that we'll be doing most of it this winter.

11

Q Now you'll be studying

12

water sources in the winter. We've heard from --

13

A From air photographs.

14

Q Oh, from air photographs.

15

This won't be an on-the-ground study.

16

A That's not contemplated

17

at the moment.

18

Q Now, you've had what you

19

called a cursory look at the air photographs and that

20

has given you the location of the compressor stations

21

with relation to bodies of water. Now you're going to

22

look at the air photos again, and what else is that

23

going to tell you about sources of water?

24

A Well, primarily the

25

waters along the Mackenzie Valley route, until you

26

get down into the 60th Parallel line, the quality of

27

water in most of these isolated lakes is reasonably

28

good for domestic purposes. If they are large enough

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so that they will not freeze to the bottom and have

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an adequate supply of unfrozen water below them, then



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2 the qualities are generally very good.

3 Q All right. Now I guess  
4 we can't look at this in isolation because you've  
5 already done some of this work for Arctic Gas, your  
6 firm. Isn't that correct?

7 A That's correct.

8 Q So --

9 A But the same type of  
10 thing for Foothills, and at about the same stage.

11 Q Right, I see, so really  
12 you've, as far as Arctic Gas is concerned as well,  
13 you've only looked cursorily at the air photographs.

14 A Right.

15 Q And you haven't done the  
16 second stage that you have described of looking at the  
17 air photographs more intensively for the purpose of  
18 determining whether they're close to good water  
19 sources.

20 A That's correct.

21 Q Now, after you've done  
22 that, I assume at some point somebody has got to get  
23 onto the ground and take a cupful of that water and  
24 see whether it's potable, and take a test-tube full  
25 of it to see what sorts of things are in it, to see  
26 whether it's suitable for the purposes that you'd  
27 wish to put it to. Is that correct?

28 A That is correct. Keep  
29 in mind, though, that we have been involved with  
30 most of the communities up and down the Mackenzie



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2 Valley for quite a number of years, and as a general  
3 rule the waters in the larger lakes where there's a  
4 good volume and good depth is potable, and generally  
5 speaking, unpolluted.

6 Q Yes, well I realize that  
7 may be the case. Arctic Gas has said in their evidence  
8 on the last panel, and in fairness to you, you may  
9 not know this but they asked me to ask you some of  
10 these questions. They said that what they wanted  
11 to produce is a clear, sparkling tasteless, odorless,  
12 substance for the use of the construction workers.  
13 Now, my own experience in northern waters is that  
14 though they may be very pure and good, they are not  
15 always tasteless substances, and if you're going to  
16 make them such you're going to have to do something  
17 to them. Isn't that correct? Or select alternate  
18 sites.

19 A Some two things, either  
20 treat or go to another source.

21 Q And some water has some  
22 color to it because it may have certain natural  
23 chemicals in it. That doesn't mean that it's bad  
24 water, it just means that it's got something in it.  
25 So somebody has to look at it from that point of view  
26 if you're going to create this substance that Arctic  
27 Gas and presumably Foot hills wants to present to  
28 its construction workers.

29 A Right.  
30



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Q And I'm interested in timing, both for Arctic Gas and for Foothills. At what stage is that to be done? I'm assuming that's something that can't be done in the wintertime, because some of the lakes will be frozen to the bottom, if you're going to take water from shallow lakes, and others will at least be frozen to the extent that it will be fairly inconvenient to take water from them. Others may be even waters like the Mackenzie that look quite turbid and full of sediment in the summertime, but in the winter when you draw ice from them or water from them it appears to be clear.

A Keep in mind the construction season is the wintertime and actually we will go in in wintertime and check these sources out as soon as we are given the go-ahead.

Q Yes, and one of the things that we've been told by Arctic Gas on the last panel was that some sites may be suitable for taking water from early in the season but that because of the thickness of ice that will develop throughout the winter, they won't be available as water sources as the construction season continues. Now we've been told by Foothills, who you appear for now, that they don't even plan to start construction until a lot of these lakes may not even be available late in January, if they're shallow bodies of water; is that not correct?

A Correct.



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Q So, as far as Foothills  
is going to be concerned, you're going to be looking  
for water sources that are available 12 months of the  
year rather than ones that you can start to use early  
in the construction season.

A Well, any water supply  
will have to do for the duration of the construction  
season, regardless of when the construction season is.

Q Well, Mr. Lawrence, though  
isn't it correct that if you're in an area where there  
is a deep lake and a shallow lake, if you started early  
enough you could start by taking water from the shallow  
lake and then go to the deep lake when the ice had gone  
to the bottom of the shallow lake?

A Correct.

Q And those are things that  
have to be assessed before you can decide where you're  
going to get water both for camp use and for construc-  
tion requirements.

A That's correct.

Q And these are things that  
have not been determined by you for either Arctic  
Gas or Foothills.

A No.

Q And if that's the case,  
then we don't know from you how far these are going  
to be from the various facilities like the camps or  
the compressor station sites at this point.

A That's correct, We do not



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know how far.

Q And therefore we don't even know the length of some of the haul roads that would be required, snow roads or permanent, in order to bring this water to the various areas where it will be required.

A That is correct.

Q And can you give me an idea from the instructions that you have received from either applicant of when we will know these things?

A As regards Foothills, we're going to start this study this winter. I would suspect there would be no problem at all in either case of having this information long before the construction starts.

Q All right, now what about Arctic Gas?

A Same thing.

Q So now, the considerations that I've given you so far are potability and availability of water, but there are other considerations that we went over with the last panel from Arctic Gas and they are the other users of the water, whether they be birds or the nine-spined stickleback. There are other competing users for this water and when you choose a site that is good for the purposes of construction and is available close to a facility or an area where it's to be used, you must then check with Mr. Bouckhout and his people to see whether there's



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2 any conflicting use, and I gather that that work is  
3 going on at the same time, though it's also not complete.

4 WITNESS BOUCKHOUT: Yes, as  
5 Mr. Lawrence has indicated, we plan to start this winter  
6 the air photo identification and in-depth air photo  
7 analysis of the water sources relative to where our  
8 need points will be. Beyond that, of course, our  
9 field studies, as you've indicated <sup>that</sup> are necessary to  
10 do, to evaluate the various sources in terms of quality,  
11 quantity, ice thickness and so on. So that will  
12 definitely be done in the future. I cannot give you  
13 an exact date as to when that will be done yet.

14 There are a couple of reasons:

15 (1) You appreciate that the compressor station sites  
16 are the sites that will need a fair bit of the water  
17 since they will be initially the sites of construction  
18 camps, and ultimately ~~the~~ site of operations-maintenance  
19 and /compressor stations. Any change in alignments to be  
20 instituted now -- in other words it doesn't have to  
21 be a major change -- we could potentially change the  
22 site of the compressor station due to hydraulics, a  
23 matter of yards or a matter of a half-mile or something  
24 like that. This is one of the reasons we feel that the  
25 actual designation of the final sites is something  
26 that's a little bit down the road yet until we are  
27 in a position where the exact location of many of these  
28 supply sites, or where the water is in fact needed is  
29 exactly pinned down. Now, certainly as you have  
30 assumed correctly, it's the case of where the water



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will be gotten since we have not designated the sites  
right now we do not exactly know what the total length  
of the haul roads would be.

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Q Mr. Bouckhout, isn't  
there another problem, that you don't want to go  
studying a whole bunch of lakes that Mr. Lawrence is  
going to tell you aren't suitable for the purposes of  
construction or supplying water to the camps or  
compressor stations?

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A That's right, you have  
to narrow it down. Obviously we can't study every  
potential water source in the entire valley from a  
biological point of view. You really have to narrow  
it down to what is usable. It's like building anything.  
Where can you build it? There's no sense studying  
a mountaintop,<sup>if</sup> you can't build it on a mountaintop.

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Q So your work can't be  
completed until Mr. Lawrence's has been completed  
with regard to quality and quantity.

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A Well, that's essentially  
correct, yes. Mr. Lawrence will have to identify the  
sources and the quality of the sources and so on,  
and the biological people will have to react to his  
identification of those sources, and put -- have their  
input into the actual use, whether those particular  
sites are able to be used from a biological point of  
view, or whether they're not; and if they're not we'll  
have to look at alternative sources.

Q Yes, and Mr. Blair or



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2 whoever is in charge of that part of the operation  
3 will also have to say, "Sorry, Mr. Lawrence and Mr.  
4 Bouckhout, you picked an ideal lake, but it's 20  
5 miles from the compressor station and we're not going  
6 to pay for building a haul road to it." So there's  
7 that economic factor that must go into this, too, and  
8 that -- your decisions must be based on that kind of  
9 consideration as well.

10 A Our recommendations will  
11 be made according to the information we have at hand  
12 and obviously economics will play somewhat of a role  
13 beyond that.

14 Q All right. Now Mr. Law-  
15 rence's job, I gather, is made somewhat more difficult  
16 because not only must he use or identify sources of  
17 water, but you have to worry about the problems of  
18 disposing of this water after it has been used, and  
19 I'm thinking in particular of the sewage at the  
20 various camps; is that correct?

21 A Right.

22 Q And in order to do that  
23 you have to make some kind of a determination of how  
24 much water is used per man per day in order to see  
25 first of all whether there's enough water for the  
26 various camps.

27 A There is a considerable  
28 amount of data available to us to satisfy ourselves  
29 that we know how much we will require.

30 Q Well, is it not true that



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1 you've examined some of the problems that Alyeska has  
2 had with water supply yourself as a consultant?

3 A Yes, that and we have  
4 an amount of other data from construction camps and  
5 oil camps.

6 Q Well, would I be fair  
7 in saying that Alyeska under-estimated the amount of  
8 water that was required per man per day in the camps  
9 on their pipeline?

10 A I think in many cases  
11 that could be right, yes.

12 Q All right, well has  
13 that caused you to come up with a figure that you  
14 think is realistic for a man-day requirement of  
15 water at these various camps?

16 A The target that we have  
17 is 100 U.S. gallons or 80 imperial gallons per man per  
18 day.

19 Q And is this the informa-  
20 tion you have given both to Foothills and to Arctic  
21 Gas as a recommended figure?

22 A That's correct.

23 Q Well, it's been suggested  
24 to me that in fact the requirement in the Alyeska  
25 project has been somewhere between 150 and 250 gallons  
26 per man-day in some of the spreads, and have you checked  
27 to see whether that <sup>is</sup> in fact is what has happened in  
28 those areas?

29 A The Alyeska data reported  
30 that anywhere from 50 to 150 was the figure.



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Q Well, I take it you'd want to err on the conservative side.

A On the correct side. The Alyeska figures are just now becoming available to us . They are a real lesson to all of us in many fields, and we certainly will take into account their experience.

Q All right, well one of the plans, I understand that Alyeska had, was so that the men could warm up and relax after working that they would use saunas, and the men decided they didn't really like saunas as much as hot showers so they used a lot more hot water showering than steam saunaing, if you will, and this threw out some of the calculations that they'd made originally.

A That is correct.

Q All right, and the concern there is not so much that they're going to use 20 gallons more a day if it's available, but that you may find that in the middle of construction you're forced to take water from sources that are important for other uses, be they fish or other people. That's what you have to worry about when you're trying to make your predictions.

A That's what we have to worry about, yes.

Q And you'll need, I put it to you, the information that you get from Akyeska to find out whether your 80 gallons per man-day is



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a sensible conservative figure.

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A Correct.

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Q Conservative, I mean --

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by "conservative" I assume you mean a high figure.

6

If it turns out to be conservative by being a low

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figure you'll want to adjust your water requirements.

8

A You only haul that amount

9

that you wish.

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Q Yes.

11

A Or have to.

12

Q And now you also talked

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about hauling water for construction -- sorry, for

14

compressor station camps and storing it. Now you'd be

15

storing it in large tanks with perhaps 80,000 gallons

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in them, is that correct?

17

A Of that order. Again

18

this has to be final design based upon the number of

19

people, number of man-days per season that the company

20

predicts that they will have on-site.

21

Q All right, now that water,

22

I gather, has to be kept heated during the wintertime

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when it's not being used or even when it is being

24

used.

25

A Right.

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Q Right. And what are the  
plans to heat that?

A Well, we expect there will  
be a source of heat here from the compressors themselves  
or from natural gas available from the line.

Q So, you might even have to  
burn some of the fuel that the facility is passing  
through in order to keep this water from freezing?

A Yes, a small amount. We  
would minimize the amount by using insulation on the  
tank.

Q Now, you have, on the  
subject of sewage, been up and down the Mackenzie  
Valley looking at the communities, looking at their  
water supplies and their sewage facilities and compared  
to what you planned to put into the camps, both the  
Arctic Gas and the Foothills Camps that you are making  
recommendations about, the sewage facilities in a lot  
of the communities are decades, generations, ages  
behind. Is that not correct? The honey-bucket is what  
most people use in small northern communities as  
opposed to the flushed toilet.

A Right.

Q What you are proposing, if  
I read you evidence correctly, is that you would install  
modern facilities in the camps and I in no way criticize  
this and that these might be available to the communities  
after the construction season is over, after the three



Bouckhout, Drew, Claridge,  
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Taylor, Reeves.  
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3 years or whatever it is, is completed?

4 A Yes, that is the company  
5 policy.

6 Q All right. Now, are you  
7 designing this equipment for the camps, or are you  
8 designing it for the communities and making it so that  
9 it will fit into the camps because I want to suggest  
10 to you that it may be that what is adequate for an  
11 800 man camp in a compact set of bunk houses, may not  
12 be adequate for a community of 800 people spread out  
13 in the way say Aklavik or Fort MacPherson is?

14 A I am quite aware of this.  
15 I think that the company statement in both cases is  
16 that the communities who have the right of first  
17 refusal. Now you just can't take a package plan designed  
18 for a camp and transpose it into a community of the  
19 same size and say this is the economic or the sensible  
20 thing to do.

21 Q All right. So, what you  
22 may be doing is making a very generous gesture that may  
23 be unusable?

24 A That is correct.

25 WITNESS BOUCKHOUT: I might  
26 that  
add Mr. Bayly/our camp sites only have 500 or 600  
27 planned.

28 Q Yes, I am sorry. I am  
29 thinking of the Arctic Gas camp size because I realize  
30 that Mr. Lawrence is doing work for both companies and



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I don't mean to suggest that your camps would be as large. Well, while we are on that subject one of the problems that was raised in the Alyeska project was that when spreads got behind, it was necessary to put more men in the camp facilities than they were designed for and that means that there is more sewage created and the requirement for a larger amount of water. Is that correct?

WITNESS LAWRENCE:

A That's correct.

Q All right. And in some of the Alyeska camps there were almost twice as many people put in as they were originally designed for. Would you agree with that?

A That is the information we have.

Q And that that created some terrific problems with regard to sewage that was ponded and the ponds were built big enough for the capacity, for the size of the camps that were projected.

A That is also the information we have.

Q All right. Now, when your designing the facilities either for Arctic Gas or Foothills, will you be designing them with some sort of a bypass system so that you can bypass your sewage plant if you run into this kind of over-population, if you will, in the camps?

A No, our concept is that we



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Taylor, Reeves.  
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3 will design the units in modules so that as you increase  
4 the number of modules and the number of people, you  
5 will also increase the number of mechanical units.  
6 The things that you were concerned about is the ponds  
7 which we put in as a secondary backup system, whether  
8 they would be adequate. I think here again, if you  
9 are going to construct these, you would err on the side  
10 of conservatism.

11 Q We get a lot of that Mr.  
12 Lawrence. I am sorry to laugh but this erring on the  
13 side of conservatism; that means you build bigger ponds?  
14 Is that what your saying.

15 A That's correct.

16 Q Okay. Would you build ponds  
17 that were twice as big as you thought you needed?  
18 How conservative are you going to be?

19 A I think if we find that the  
20 Alyeska experience indicates a factor of two, then we  
21 will go for a factor of two, yes.

22 Q All right. Now, Mr.  
23 Williams for Arctic Gas was able to tell us that you can  
24 ration water but you can't ration sewage the same way.  
25 You really have a problem there if you bring in too  
26 many people, don't you? If you don't build it big  
27 enough you have either got to bypass your system or you  
28 have got to go in for some other kind of system and maybe  
29 go back to the honey-bucket for all I know in order to  
30 keep from discharging this say, straight into a water



Bouckhout, Drew, Claridge,  
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 Taylor, Reeves.  
 Cross-Exam by Bayly

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course that your trying to avoid?

A Yes, I would say so but  
 keep in mind again, we hope that they will follow our  
 advice and that where they have a module for so many  
 people, they will also include in that module the  
 treatment unit that goes with it.

Q All right. Now, your a man  
 whose been in this sanitation business for some period  
 of time. Can you tell me if for example, one of the  
 applicants is successful and orders this kind of  
 equipment and the men that it requires to install it,  
 whether it would change the cost factor considerably  
 if the government was to co-operate to upgrade the  
 sewage facilities and treatment facilities in the  
 adjacent communities by ordering at the same time?  
 In other words, if you at the camp near Aklavik order  
 in a sewage treatment facility that's suitable for  
 an 800 man camp, and the government were to order in  
 for Aklavik at the same time, from the same manufacture,  
 whatever was required there to give similar kind of  
 sewage treatment, would you be facing a great saving?  
 I don't mean you as the applicant?

MR. GIBBS: It's almost an  
 impossible question to ask this witness what their  
 volume discounts are going to be five or ten years  
 hence.

Q No, I am not asking for  
 actual figures, Mr. Commissioner, but I am asking a man



Bouckhout, Drew, Claridge,  
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whose a sanitary engineer--

THE COMMISSIONER: I would  
like you to take a stab at that sir, if you would. If  
you can't help us, you can't.

A Well, when you get problems,  
one is the domestic sewage from a town and it is  
entirely different than the domestic sewage at a camp.  
Camp sewage is normally much stronger. What you would  
put into a town and the standards that are required  
for the towns in the Northwest Territories are entirely  
different than we have in these camps. The standards  
that are being required for these camps are much  
higher. The camps also have many facilities available  
to them that are not available--

THE COMMISSIONER: Have what  
facilities?

A Facilities: Mechanics,  
electricians, plumbers, welders available to them that  
are not available in a little town. It was the same  
experience that we have on the Prairies, where we have  
gone to lagoons because simply they require one man  
days operation per two or three months rather than a  
constant crew. And if you again refer to your Alyeska  
figures, as I am sure you have, some of those camps  
have got staffs of seven or eight people per a thousand  
people on staff, including electricians and plumbers.  
The manpower requirements for the type of camp we are  
talking about is not inducive for municipal use.



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Bouckhout, Drew, Claridge,  
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3 Q All right. So, if I go  
4 back to your original plan, or the companies original  
5 plan, and that is to give the communities the right  
6 of first refusal to this equipment, may I suggest to  
7 you sir that it is virtually useless to them. They  
8 haven't got the people to install it, it is not meant  
9 for their kind of community sewage problems, it really  
10 is a meaningless kind of offer, because it just can't  
11 be used.

12 A I might agree with you but  
13 that still is the company policy.

14 THE COMMISSIONER: I had  
15 forgotten. You are advising both companies.

16 A That's correct.

17 THE COMMISSIONER: Is that  
18 the policy of both?

19 A That's the policy of both  
20 companies.

21 MR. BAYLY: If I can quote  
22 then from a report that Associated Engineering prepared  
23 in 1973 and I believe it was Mr. Gamble who prepared  
24 this report and it is found in a volume which was lent  
25 to me by Arctic Gas called "Land for Waste Management  
26 Proceedings of the International Conference, October,  
27 1973".

28 THE COMMISSIONER: Mr. Gamble?  
29 You don't mean our Mr. Gamble?

30 MR. BAYLY: Our Mr. Gamble, sir.



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MR. SCOTT: I presume the

WITNESS LAWRENCE: I also

MR. BAYLY: This quote on page

"While there is no quick and easy solution to the

And if I can suggest to you

A I think actually that the

ed, not only from the use of

equipment or sanitary equipment,

but also from many other things which may be available

in the camps, surplus equipment. And I think it applies

to more types of equipment than merely these two. But

your evidence was only referring to this particular



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kind of equipment.

A That's correct.

Q Yes.

MR. MARSHALL: Just on this  
point Mr. Bayly. Mr. Hemstock has left and I can't  
confer with him on checking with the other representatives  
of Arctic Gas here. None of them are certain as to  
what the policy of the company is in that area. We'll  
have some clarification on that probably in the fourth  
phase.

MR. BAYLY: Mr. Commissioner,  
I was quoting from a paper by Mr. Hemstock to that  
conference. I don't mean to say that that's the policy  
of the company but he is the one who was quoting  
Associated Engineering.



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WITNESS LAWRENCE: A I

think the terminology was right of first refusal. It is not going to be forced on somebody and say take it or leave it.

Q I'm not suggesting it is, sir, and I am not suggesting that it is not a generous offer. I am trying to allude from you whether it is an offer which is practical and I think your answer is that really in most cases, it isn't practical to take second-hand equipment from a camp and try and install it in a community even if they are the same size, the problems are different.

WITNESS BOUCKHOUT: A If

I might, Mr. Bayly, I might add just a bit to this. One of the options we do have and our socio-economic panel will be speaking to this a bit more as well but one of our options, of course, is to train people in the north, local people in the north to operate these particular units for us on our camps and this would immediately mean, of course, that these people if we did in fact, pursue this, would mean that these people would be capable of operating these units and possibly back in their own particular townsites would be capable of operating these. As I say, this is an option and I would like to leave it open to the socio-economic panel to expand on it.

Q All right. Yes, I understand that these units as a matter of fact, Mr. Lawrence, take men on the job full time -- trained men to



Bouckhout, Drew, Claridge,  
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Cross-Exam by Bayly

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operate them. Is that not correct?

3

WITNESS LAWRENCE: A That

4

is correct.

5

Q So you probably in a camp

6

for example have, excuse me, two or three shifts of

7

men who did nothing but look after the sanitary disposal

8

equipment?

9

A Well, you can, again

10

going back to municipal experience, it's not necessary

11

to have it 24 hours a day very often. And certainly

12

with trained staff available for 24 hours if you

13

need it.

14

Q All right. But you do

15

need the trained staff there and that is one of the

16

problems you raised, that they might not be in the

17

communities unless they were trained on the job with the

18

company and I gather that there is no guarantee that that

19

will happen. That is a question of whether the people

20

in the area respond to the company training programs.

21

We'll get into that later on.

22

Now, the one thing that

23

I would like to question you on from one of your

24

answers is you said that the sewage problems essentially

25

are different in these camps than they are in the

26

communities and you used the word 'stronger' and there

27

was some doubt in my mind as to what you meant. Does

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that mean that there is more of a concentrated use of

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the facilities or -- ?

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A No, I would say pounds per



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A        No, but I would suspect  
that in concept we are talking roughly the same thing as  
we are here.



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Q All right. And that is  
Associated Engineering is doing that work?

A Virtually yes.

Q Well, I'm sort of confused  
because I have assumed that Associated Engineering was  
doing the work for Arctic Gas and Foothills. You are  
retired and you are doing the work. Is that right?  
Or is Associated Engineering doing it?

A The Associated Engineering  
are <sup>a</sup>continuing company. I commenced this work before  
retirement and am just carrying it on.

Q So, you are the person  
who will be continuing on whichever of these projects  
is successful?

A Not necessarily. I don't  
intend to give up retirement that easy.

Q One more area, Mr. Lawrence,  
on the treatment of both water and sewage. Both  
can be treated, as I understand, with chlorine for  
different reasons, of course, and is it contemplated  
by either of your employers that chlorine will be used  
either in the purification of water or in the treatment  
of sewage affluence?

A Always. This is essential  
This will always be done.

Q So, will that involve  
large amounts of chlorine at the various camp facilities  
or in the case of Foothills at the camp compressor  
station site facilities?



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A No. For small camps,

would suspect we would use domestic bleach which is our  
Perfex or one of these which has got 15% available  
chlorine in it.

For larger types of  
camps, we would use HTH in either powder or tablet  
form.

Q Could you explain to the  
Commission what HTH stands for?

A Calcium hypochlorite  
That material, we would require roughly 50 pounds per  
hundred people per 5 months. The quantity of chlorine  
that you are aiming for is a residual of .3 parts per  
million. In other words, a million pounds of water has  
got .3 parts residual chlorine in it. In order to get  
that, you have to -- may have to -- feed, depending on  
the quality of water, anywhere from one part to five  
parts to start with.

Now, the residual would  
come back to .3 as it acts on the organic matter in the  
water.

Q Now, in your determination  
of the amount of chlorine that would be needed for  
purification of water supplies, have you been in contact  
with the fish biologists of either Foothills or Arctic  
Gas to see whether that is an acceptable level of  
chlorine in water to be discharged back into any water  
course?

A Now, yes, .3 is domestic



Bouckhout, Drew, Claridge,  
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1 water. It's, I think in your fish tanks for your  
2 gold fish, you would de-chlorinate from that level but  
3 .3 parts which is your domestic water supply residual is  
4 not harmful to fish. No, if you are talking about  
5 chlorination of sewage before discharge, that is  
6 something different again.  
7

8 And our team did contain  
9 a fish biologist who strongly recommended against  
10 chlorination of sewage prior to discharge. Primarily  
11 for this reason, in case it was ever entered loose  
12 into a stream where there were fish.

13 Q All right. And has that  
14 been something that you have been able to get around?  
15 You did say in your earlier answer that you always use  
16 chlorine in the treatment of sewage affluence.

17 A That is your water for  
18 domestic purposes. No, I didn't say for sewage, I said  
19 for water.

20 Q I see. So you can get  
21 around that in the sewage by using your ponding method  
22 and then discharging it as either primarily or secondarily  
23 treated sewage into a swamp area which seems to be the  
24 Arctic Gas favoured method in any event?

25 A That is correct. Sewage  
26 has a very high affinity for chlorine. But the value  
27 of it is very doubtful in any treatment process. Really  
28 all it does, is kill off the bacteria and that is the  
29 very type of thing you don't want to have to have so  
30 instead of having bacteria growth which is only essential



Bouckhout, Drew, Claridge,  
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2 for the stabilization of any sewage. All you are doing  
3 is delaying the process so that if you introduced a  
4 highly chlorinated sewage affluent into a stream, the  
5 bacterial action which you would want would not take  
6 place in maybe the first mile, two miles, or three  
7 miles of the stream but it will start again ten miles  
8 down the stream.

9  
10 I see it as a delaying  
11 action and the advantages in my opinion are doubtful.  
12 However, we would still be required -- may be required --  
13 by health, either regulations or monitoring groups, to  
14 chlorinate. This would be a Department of Environment  
15 decision.

16 Q All right. And this might  
17 happen because at least in the Foothills example, we  
18 have seen a drawing of the compressor station campsite  
19 in which the lagoon is placed very close to buildings  
20 where people will be living or working and for that  
21 reason, you might have to introduce the chlorine. Is  
22 that right?

23 A No, no, no. That is the  
24 last reason we would want to introduce chlorine,  
25 because of that. That's not the point at all. The point  
26 of introducing chlorine is that in the event that the  
27 water is discharged into what could become the drinking  
28 water supply of somebody down the street.

29 We would not introduce it  
30 into a lagoon regardless of how close it was to the camp.

Q All right.



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Now, the application seemed to suggest that there aren't situations where the recommended procedure would be to put sewage effluent into flowing water.

A We would recommend highly against that. The preference seems to be to put it into swampland.

Q The preference seems to be to put it into swampland.

A Right.

Q Now, Arctic Gas as an applicant seems to think that you put it into swampland because the swampland isn't any good for anything else.

MR. MARSHALL: I don't know if that's a fair summary of any evidence given by Arctic Gas, Mr. Bayly.

MR. BAYLY: I think I may have worded it somewhat too strongly, Mr. Commissioner, but they seemed to think that it wasn't very useful for any other living things?

A Our concept on both things is exactly the same. We suggest that they go to a mechanical plant and some type of a holding pond which would act as a back-up system in the event of any mechanical failures and from then discharge into swamplands.



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In both cases both companies have adopted the same procedure.

Q Now with regard to contingency plans, if you do get into the kind of problem that I've suggested to you where for some reason on some site you aren't as conservative as you wanted to be, and you have to either by-pass your system or discharge it directly into some place you don't want to, how are you going to ensure that it isn't going to go into flowing water?

A Well, this is going to be a matter of final design in the fact that you can pipe sewage in wintertime in coldest weather for quite a considerable distance, and pump it so that you have a choice of where you discharge sewage, or where you have a pond or what you use for a pond. There's all kinds of alternatives.

Q Fine. Well, would you be prepared to suggest to either applicant you're working for that they keep in certain sites backup equipment such as sewage pump trucks so that this material could be transported in the event that something went wrong with the capacity of the system?

A No, I don't think I would ask for pump trucks. I'd rather ask for a portable pipeline facility.

Q Well, let's say you have the portable pipe and you take your portable pipeline, that is your sewage pipeline, and you're pumping



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sewage say to a pond. What you're really doing, I'm going to suggest to you, is to pump it onto ice in a lot of cases; is that not correct?

A I don't think we'd pump it into a pond unless this was agreed to by the environmental people with whom we were dealing.

Q Would you pump it onto the land?

A We'd pump it onto the land, preferably in bog areas or heavily treed areas.

Q All right. These would be areas that might well, especially if they were bog areas, have a fair amount of ice in them. Would that not be fair to say?

A Yes, frozen, because we're dealing with wintertime.

Q Well, some of it might well migrate in the springtime when that ice on the bog turned into water, areas that might be wet and moving in the springtime, and dry later on.

A Yes, this water becomes part of the natural water then in the area.

Q All right. The thing that concerns me, Mr. Williams, is I realize the necessity to leave some things to final design. But what my concern is is that final design often involves a, "What do we do now that we've got the problems" situation? In other words, that you will say, "Our conservative estimates have made such-and-such plans.



Bouckhout, Drew, Claridge  
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2 We've got too much sewage, we've got to do something  
3 with it. It's the middle of winter. We haven't got a  
4 place to put it, but assume that this is a good  
5 place."

6 Will you be doing an exten-  
7 sive design before you even decide where the facility  
8 goes to decide, "Well, in the event of an emergency  
9 we can at least put the sewage over here on this  
10 piece of low ground. There's no drainage from it.  
11 There's no danger of it getting into an active water  
12 course." How final is "final design" in the kind  
13 of work that you do?

14 A We will possibly put  
15 it as belt braces and suspenders. You take everything  
16 into account with a backup system. The quantities  
17 of water we're dealing with are relatively small and  
18 the areas that we're going through, as I assess them  
19 from photographs and my knowledge of the country,  
20 is that we are not going to hit situations where a  
21 spill of 100,000 gallons of water is a critical item.

22 Q I'm not thinking so  
23 much of 100,000 gallons of water, as 100,000 gallons  
24 of sewage.

25 A Treated sewage, I hope.

26 Q This is the problem,  
27 isn't it? If you can't contain it in the treatment  
28 facility when you're overloaded, then you have raw  
29 sewage and you've got to do something with it?

30 A I think, though, that



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2 if you want to go into practical items where this  
3 has happened and is happening today, you'll find that  
4 the results are not catastrophic whatsoever. even in  
5 the close environment. You keep quoting the Hay  
6 River experience, but you can quote the Whitehorse  
7 experience where the Federal Government through their  
8 Camp Takhini and all the rest of it, have been discharg-  
9 ing raw sewage into a swamped area for roughly 20  
10 years, in my experience, and the immediate effects are  
11 evident for a distance of approximately 100 feet from  
12 the discharge point; but 300 feet away they're not  
13 discernible.

14 Q Although with your  
15 other two examples, you can't swim at the beach at  
16 Hay River and you're not supposed to drink the water  
17 out of the back bay at Yellowknife. Am I not correct,  
18 sir?

19 A Right.

20 Q So that there are those  
21 kinds of problems to consider.

22 A Yes.

23 Q And wherever --

24 A They're not catastrophic.  
25 Neither one of those are catastrophic.

26 Q Unless you live on the  
27 back bay.

28 A Well, yes, but we were  
29 talking about something now that has developed over a  
30 period of 20 years or so, and we're not looking at that



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type of thing in a construction camp.

Q Yes, you are looking at a short period of time but you are looking at a problem that could be serious for a significant period of time for downstream users of a river course into which some of this matter might escape. You only have to get a disease once, like hepatitis, and you remember it a long time. That's true, isn't it?

A That's correct, yes.

Q Now, one of the sites that we were discussing when Arctic Gas was last on was compressor station CA-05 which is close to the Komakuk Beach campsite, are you acquainted with that?

A No, I'm not.

Q All right. If I can just describe it to you, it's on the North Slope and the site itself is almost on the beach, it's very close to the beach, from the map there is one lake from which Arctic Gas says it would like to draw its water and there's some low land around it that is marked with those things that look like reeds, and I assume that that's swampland. Given a situation like that, being on the Beaufort Sea, would you contemplate that the logical place to put the sewage would be into the Beaufort Sea?

A It's certainly one of the alternatives.

Q And I'm assuming you will be given this as a problem, or Associated Engineering



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will because they will have to do something with the  
sewage there. My difficulty here, Mr. Commissioner,  
is I was referred to this witness as the person to  
discuss that with, and it's not his fault but he isn't  
acquainted with that site.

MR. MARSHALL: No, I don't  
think that's quite right, Mr. Bayly. I indicated to  
you that Mr. Lawrence would be on Foothills panel and  
as he had indicated in his prepared direct evidence  
for Foothills, basically the approach is the same.  
That's what I said, and I said as well that Mr. Williams  
who was on the panel and could answer questions pert-  
aining to sewage and I think that's the way it was  
put. Sorry if you misunderstood that.

MR. BAYLY: Mr. Commissioner,  
I don't know, I can't resurrect it in my mind now but  
my assumption is that it was certainly Associated  
Engineering that had done the sewage treatment work  
and I had put on the record that I was going to  
defer my questions in that area, and everybody seemed  
happy with that.

THE COMMISSIONER: My recollec-  
tion is very much like your own, but now that we are  
here it doesn't matter if you had deferred them or  
not, there was no one then who could answer them,  
and there's no one now who can answer them. Isn't that  
the situation?

MR. BAYLY: I think that's  
probably the situation,



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MR. MARSHALL: Well, Mr.

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William is going to be back in the Grand Hall tomorrow  
 as I understand it. He's received a special engraved  
 invitation from Mr. Gibbs and perhaps Mr. Bayly, if  
 there are some areas that you want to go back into  
 if Mr. Williams is not able to answer them, and you're  
 not able to get answers now from Mr. Lawrence, we can  
 give an undertaking to provide the information.

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MR. BAYLY: I'd be happy to  
 ask Mr. Williams, but it may well be that the sensible  
 thing to do would be to request of Mr. Lawrence before  
 he leaves <sup>that</sup> he have a look at that site and give us at  
 least some tentative solutions to the sewage problems  
 at a camp of that nature before he leaves, assuming he  
 will be here tomorrow. Would that be considered to be  
 Gibbs, whose witness he is?

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MR. GIBBS: It's agreeable  
 to me. Of course the question is whether Mr. Lawrence  
 can give you a sensible answer on such short notice.

22

23

24

MR. BAYLY: Well, if he  
 can't, Mr. Commissioner, I'm quite happy for him to  
 say he can't, but I would like him to look at that  
 particular camp as it's one that's of concern to me.

25

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27

MR. GIBBS: Well, perhaps  
 Mr. Commissioner, he can indicate what he wants from  
 Mr. Lawrence. I don't know and I'm not sure that he does.

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MR. BAYLY: Q Mr. Lawrence,  
 do you understand that I'm interested in the campsite  
 at Komakuk Beach which is on the North Slope and it's



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

close to compressor station, Arctic Gas' compressor station site CA-05, and it's found on an alignment sheet which I can find for you and perhaps you could give us your opinion as to the possible alternatives for the discharge and/or treatment of sewage at that site.

WITNESS LAWRENCE: Yes, I'd be prepared to give you an opinion.

THE COMMISSIONER: All right, well I think maybe we should adjourn now until this evening.

MR. BAYLY: I'm content with that, sir.

THE COMMISSIONER: All right, eight o'clock then.

(WITNESSES ASIDE)

(PROCEEDINGS ADJOURNED TO 8 P.M.)



G.L. Williams  
Cross-Exam by Gibbs

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. GIBBS: Mr. Commissioner,  
might I introduce Mr. J.W. Lutes, who is my colleague  
before the National Energy Board, who will be here in  
my place tomorrow as I have to return to Calgary, and  
Mr. Hollingworth is engaged on other matters, not of  
life or death, but of life only.

THE COMMISSIONER: He's  
proving to be of great assistance in the circumstances,  
no doubt.

MR. GIBBS: He recalled to me  
that he wasn't even married when the hearings began  
and now he's about to be a father.

GUY LESLIE WILLIAMS, resumed:  
CROSS-EXAMINATION BY MR. GIBBS: Mr. Williams, you  
no doubt recall giving rebuttal evidence on October  
17, 1975?

A Yes sir.

Q And during the course of  
giving that rebuttal evidence you introduced some  
documents which were marked as exhibits, and in par-  
ticular, Exhibit 285, which I believe was entitled at  
that time:

"A Productivity Comparison in the Inuvik Area."

A Yes sir.

Q And Exhibit 286, which  
consists of three pages of working light tables.

A Yes sir.

Q Starting first -- and you



G.L. Williams  
Cross-Exam by Gibbs

1 do have those before you, Mr. Williams?

2 A Yes sir.

3 Q Starting first with  
4 Exhibit 286, the working light tables, will you turn  
5 to the third page, which is entitled,

6 "Working light at Inuvik, 68 degrees 18 minutes  
7 North Latitude."

8 A Yes sir.

9 Q And that demonstrates  
10 taken from the Smithsonian Meteorological Tables, the  
11 duration of daylight from October 1 to April 25 in any  
12 year.

13 A Yes sir.

14 Q And the next column is  
15 the duration of civil twilight in any year for the  
16 same time period, and the next column is the total  
17 hours of working light, which I take it is the addition  
18 of duration of daylight and duration of civil twilight.

19 A Yes, sir, as defined  
20 by the Smithsonian Institute.

21 Q And this is -- was marked  
22 as an exhibit to cover the general area of Inuvik.

23 A Yes sir.

24 Q And I take it that would  
25 start at the most northernmost point of the supply  
26 lateral to some distance south of Inuvik.

27 A That was the intent,  
28 yes.

29 Q How far? Over what mile-  
30 age range would one expect to consult page 3 of Exhibit



G.L. Williams  
Cross-Exam by Gibbs

1 286 from north to south?

2 A The table actually just  
3 applies to that specific latitude, Mr. Gibbs. I  
4 don't know how far north or how far south it extends.  
5 It was just submitted for illustrative purposes of  
6 the Inuvik area. Inuvik in particular.

7 Q Well, the Exhibit 286  
8 covers working light at Inuvik, working light at  
9 Norman Wells, and working light at Fort Simpson.  
10 How many of your spreads would working light at Inuvik  
11 generally be attributable to?

12 A I would think about  
13 one spread over two seasons, two seasonal spreads.

14 Q And the one spread is  
15 the one which you expect to cover 74 total miles in  
16 each season? There was intended to be a rising  
17 inflection and a question mark.

18 THE COMMISSIONER: Get that  
19 on the transcript.

20 A I'm sorry, I've lost the  
21 question, but I think the foremost northern spreads of  
22 the Arctic Gas construction schedule each contemplate  
23 75 miles per season. Was that the question?

24 MR. GIBBS: Yes.

25 A Thank you.

26 Q And that would be covered  
27 by working light at Inuvik would apply to that northern-  
28 most spread.

29 A I think that's fair, yes.

30 Q And that northernmost



G.L. Williams  
Cross-Exam by Gibbs

1 spread is where Canadian Arctic Gas says that it can  
2 cover 74 total miles in a working season, and Foothills  
3 says 45 miles in a working season.

4 A Yes sir.

5 Q And in that northernmost  
6 spread Canadian Arctic Gas says 136 calendar days  
7 available, and Foothills says 90.

8 A Yes sir, that's my under-  
9 standing.

10 Q And --

11 MR. MARSHALL: I think your  
12 evidence also was that you were going to install the --

13 MR. GIBBS: Not my evidence.

14 MR. MARSHALL: -- the  
15 laterals, as well. I think your panel's evidence was  
16 that they were also going to install the laterals.

17 THE COMMISSIONER: I remember  
18 that, Mr. Marshall, but that was inconsistent with the  
19 figures, but I think we should let Mr. Gibbs pursue  
20 this. It's a question of daylight hours and --

21

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G.L. Williams  
Cross-Exam by Gibbs

Q And on, and I'm reading from Mr. Williams' exhibit 285, not from my own panel's evidence. And Mr. Williams, in that northern spread, Arctic Gas says there are 92 total working days available and Foothills, 67 1/2. Is that correct?

A As far as the Arctic Gas number of 92 working days, I can say that is what our construction schedule and estimate -- cost-estimate -- is based on. It's -- what is the word I am looking for -- it's an estimate based on available data, Mr. Gibbs, that I can't say that there are 92 days. Whether it is 95 or 94, that's our best estimate but I don't know about the Foothills' estimate, how they approached it. But from Arctic Gas, it was our best estimate of taking into account of weather days and what not --

Q Well, Mr. Williams, isn't that what you have told the Inquiry in exhibit 285 that Arctic Gas says that there is 92 total working days available? Now, I'm not trying to pin you to 92 now. Whether it's 95 or 98 or 90. That's what you say is going to be available by your northern most spread.

A Yes, sir.

Q And you also said in exhibit 285 to Inquiry that the Foothills had said that there would be 67 1/2 total working days available.

A That's what I deduced from the Foothills' evidence, yes.

Q And the difference between total working days available and total calendar days available is down-time?



G.L. Williams  
Cross-Exam by Gibbs

Is that correct?

A Non-productive days, yes.

Q Yes, and those non-productive days are due to what?

A In the case of Arctic Gas, mainly weather. There is a small allowance in there for Christmas shutdown but it's mainly weather.

Q And what weather in Arctic Gas's opinion would cause a shutdown? What weather conditions?

A Severe low temperatures, not so severe low temperatures with blowing winds, blowing winds with restricted visibility irrespective of temperature, ice-fog.

Q You have a temperature cut-off point below which your crew in the northern spread would not work?

A No, sir.

Q Well, I thought you said stand-down would be due to cold temperatures and you can't tell me how cold is too cold to work?

A No, sir.

THE COMMISSIONER: You are talking about equipment failure, are you?

A No, Mr. Commissioner, I think it's a function of what protective measures you take for people more than the equipment and how elaborate the procedures you go to to protect your working people or to spell them off, the number of people of the -- how you house them in, how you provide



G.L. Williams  
Cross-Exam by Gibbs

1 temporary shelter that you pull along the right-of-way  
2 to spell people off and we haven't finalized these  
3 plans.

4 MR. GIBBS: Q Mr. Williams, purely to  
5 arrive at the total working days available of 92  
6 which results from subtracting down-time from calendar  
7 days available, you must have assumed some temperature  
8 below which you would not have your northern spread  
9 working?

10 A No, that doesn't necessarily  
11 follow, Mr. Gibbs, because you would have to analyze  
12 many years of temperature data to come up with a  
13 reasonable number. And we have certainly looked at  
14 quite a bit of temperature data, but we haven't done  
15 a statistical analysis on it and we looked at some.  
16 We talked to contractors, we talked to people who  
17 have worked in the north and we came up with our best  
18 estimate.

19 Q But you cannot give me  
20 the foundation for the estimate which is the temperature  
21 below which you would not put men to work?

22 A Not in the Inuvik area. I  
23 have done such an analysis on the -- in Alaska for  
24 in a response to<sup>a</sup> Federal Power Commission question. I  
25 have done such an analysis looking at daily temperatures.

26 Q Yes. We'll come to  
27 Alaska. Then the other shutdown time might be due you  
28 said to a combination of temperature and wind and that  
29 as I understand it, Mr. Williams, produces a number  
30 called the chill factor. Is that correct?



G.L. Williams  
Cross-Exam by Gibbs

1 A Yes, sir.

2 Q And can you tell the  
3 Commission what chill factor is the cut-off point  
4 below which you will not put men and equipment to  
5 work in the Inuvik area?

6 A No, sir.

7 Q And you have made no  
8 assumption as to that factor?

9 A Not specifically. We  
10 have considered this in a general manner.

11 Q All right. Then the third  
12 condition which you said would induce you to have down-  
13 time was visibility due to fog, I believe you said.  
14 ice-fog.

15 A That's one. Blowing snow.

16 Q Blowing snow. And have  
17 you established any visibility limits which would lead  
18 you to shut down the crew because of the impossibility  
19 of working in that visibility?

20 A No, and I don't think that  
21 I would put it as strongly as an impossibility.

22 Q All right -- impracticality  
23 then. Whatever you wish.

24 A No, it again is a function  
25 of what you -- the amount of work you want to put into  
26 preparation and what you want to put up with, Mr. Gibbs.  
27 Seismic crews, drilling' crews. They work out in these  
28 conditions and they don't shut down any appreciable  
29 time.

30 Q Then sir, how could you



G.L. Williams  
Cross-Exam by Gibbs

1 arrive at 92 working days available in exhibit 285  
2 without assuming temperatures or chill factors or  
3 visibility conditions?  
4

5 A By looking at temperature  
6 data, wind velocity, and discussion with people who  
7 have had experience in the north.

8 Q Well, Mr. Williams, that  
9 is great to look at these data and have these discus-  
10 sions but surely you have to pick a point and apply it  
11 to the average temperature conditions and average days  
12 and say this much shutdown time is inevitable because  
13 of low temperatures?

14 A No, sir, I don't agree.

15 Q Well, where did you get  
16 your 92 total working days available?

17 A Well, I think I have  
18 explained that.

19 Q Well sir, it seems to me  
20 that you have pulled a figure out of the air. You  
21 have made no assumption as to cold, no assumption as  
22 to chill factor, and no assumption as to visibility.  
23 Now, surely those are basics to arrive at your 92  
24 working days.

25 A No, I don't agree. Because  
26 there are means that can be taken to overcome some of  
27 these difficulties. For instance, cold weather is one  
28 that can be overcome by providing shelter and whatnot.  
29  
30



Williams.  
Cross-Exam by Gibbs

1  
2 Q Mr. Williams then tell me  
3 the process you went through to arrive, to reduce from  
4 136 calendar days to 92 working days?

5 A It was our best judgment  
6 on the data that we had availability.

7 Q You can't tell me step  
8 by step on a logical, rational, mathematical computation?

9 A No, sir. It was a matter  
10 of pure judgment based on certain data available.

11 Q It might just as easily  
12 be 80 working days or 100 working days.

13 A No.

14 Q Why not Mr. Williams.?

15 A Because there are measures  
16 that can be taken.

17 Q Well, surely those measures  
18 that could be taken could produce 136 days?

19 A Yes, sir.

20 Q Why not do that then? Why  
21 cut off at 92?

22 A It's a matter of economics,  
23 as I say, what steps you want to take to assure that  
24 people can work out in these elements safely--

25 MR. MARSHALL: Surely as a  
26 Mr. Gibbs  
farmer, /you have had to put up with worse.

27 MR. GIBBS: Not when I was  
28 cross-examined. I wonder how you arranged that Mr.  
29 Marshall.

30 THE COMMISSIONER: I think you



Williams.  
Cross-Exam by Gibbs

1  
2 should have better control over the members of your  
3 staff.

4 MR. GIBBS: I want to try  
5 with you one more time Mr. Williams and ask you whether  
6 there is no basis upon which you can give a more firm  
7 calculation of the 92 working days other than that it  
8 was a matter of judgment.

9 A Well sir, I can  
10 only qualify it again Mr. Gibbs that it is a matter of  
11 judgment based on an analysis of temperature and other  
12 weather data along with discussions with people that  
13 have worked in these elements.

14 Q And what did the  
15 people who worked in these elements tell you about the  
16 weather temperature below which you could not expect  
17 productivity from a pipeline crew?

18 A Well, un-  
19 fortunately there haven't been too many pipelines built <sup>in Canada</sup>  
20 in the Inuvik area. So, we have to take their experience  
21 in other operations and try and relate it to pipeline  
22 construction.

23 Q All right. What  
24 other kind of operations can you relate to pipeline  
25 laying construction?

26 A Well, seismic  
27 operation requires a substantial amount of outside  
28 work. I think there are operations there that are  
29 comparable.

30 Q And you talked to people



Williams.  
Cross-Exam by Gibbs

1  
2 who have conducted seismic operations in the Inuvik  
3 area in the wintertime?

4 A Yes, sir.

5 Q And what did they tell you  
6 about the maximum below zero or freezing temperature,  
7 beyond which you would not conduct operations?

8 A Well, we were lead to  
9 believe that they worked most days, that they--

10 Q Oh, Mr. Williams surely--  
11 Well, I am saying you can't  
12 work below, 50 below, or 25.

13  
14 A I know there is-- No,  
15 there are published statistics. I don't know if I have  
16 them with me, but I did receive some of the standards  
17 that were set in the U.S.S.R. and I have read your  
18 application that discusses chill factors but I still  
19 think that it is a function of the preparatory measures  
20 that you adopt to assure that you can work these kind  
21 of days.

22 Q Well, in essence Mr.  
23 Williams, you have picked 92 days because you guessed  
24 that that's probably what you could do out of 136.  
25 Isn't that it. No matter what else you read, who else  
26 you talked to, you guessed at 92 days?

27 A That was a judgment based on  
28 data that we had available at the time.

29 Q Well, isn't that exactly  
30 the same as being<sup>a</sup>/guess of what you could do?



Williams.  
Cross-Exam by Gibbs

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A No, sir.

Q All right. Let's use the judgment basis.

A Yes, sir.

Q And it's that 92 days that says that you can do 74 total miles? Isn't it?

A After arriving at the 92 days then we fixed a spread size in the way of people and equipment to achieve that mileage.

Q Yes, and if it's not 92 days, but 80 days, your not going to get 74 total miles are you?

A Yes, I think we still can.

Q I see. And how are you going to do it if you only have 80 days instead of 92?

A 80 days in the period that we, that this number is based on Mr. Gibbs which is based on from December 1 to April 15. That is the 136 days. That is what we showed in the application. That is what the bar graph in the application shows. And if you recall that application was written two years ago and since that time we have become more confident in achieving an earlier start and we have said several times that we will start as soon as we can and in my opinion that early start in the Inuvik area is not later than November 1. In fact, I think it can be started sometime in the latter part of October. Then if you take the 136 days from there and you say that out of that 136, you can only get 80, and this takes



Williams.  
Cross-Exam by Gibbs

1  
2 you then, say from the first of November to the middle  
3 of March, then there are still 30 days in which to  
4 achieve, to obtain that extra 12 days that you were  
5 speaking of.  
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G.L. Williams  
Cross-Exam by Gibbs

1 Q Well surely, Mr.  
2 Williams, if you say that you're going to get 74  
3 miles in 92 working days, if you've only 80 working  
4 days you're going to get 8 over 9 times 74 miles,  
5 aren't you?

6 A I don't think you've  
7 been listening, Mr. Gibbs.

8 Q I was listening. I was  
9 wanting the answer to my question. I didn't think I  
10 got it.

11 THE COMMISSIONER: Would you  
12 mind repeating that question for me?

13 MR. GIBBS: Q Well sir, in  
14 Exhibit 285 Mr. Williams has told us that in 92 total  
15 working days he's going to get 74 total miles, and I  
16 have suggested to him that if his 92, which he  
17 calls a judgment is wrong in his judgment and  
18 it really becomes 80, he must have proportionately  
19 less than 74 miles. Now isn't that so, Mr. Williams?

20 A No sir. Do I have to  
21 go through that explanation again?

22 THE COMMISSIONER: Would you  
23 for my benefit, because I didn't follow you the first  
24 time around, I'm sorry. If you don't get the 92  
25 days, if you only have 80, you have to have more people  
26 and more equipment presumably on the job to get in the  
27 74 miles in 80 days. That's what I assumed when you  
28 mentioned that earlier.

29 A Well, Mr. Commissioner,  
30 do you recall the evidence that was given by Mr. Dau



G.L. Williams  
Cross-Exam by Gibbs

1 and myself jointly late one -- or early one morning  
2 with respect to the contractor participation in the  
3 Canadian Arctic Gas construction scheduling and  
4 cost estimates? In that evidence --

5 Q You had estimates from  
6 a number of prominent pipeline contractors.

7 A Eight contractors, and  
8 in that evidence -- and I think it was filed with the  
9 Commission and I haven't got a copy here -- where  
10 Mr. Dau presented a comparison of the estimates made  
11 by the contractors<sup>a</sup>/comparison to estimates made by  
12 Canadian Arctic Gas, and in the area that Mr. Gibbs  
13 is discussing it shows that the 75 miles in the Inuvik  
14 area in Arctic Gas' estimate would be achieved in  
15 136 calendar days. Out of that 136 calendar days based  
16 on the judgment as we've been discussing, we said that  
17 there would be 92 working days. We also said that  
18 that period, that 136 calendar days, in accordance with  
19 our application, extended from the 1st of December to  
20 the middle of April, 4 1/2 months.

21 Q Right.

22 A That's what we filed  
23 in the application for this particular area. The  
24 work, the welding, which the schedule is based on,  
25 the welding work starting on the 1st of December and  
26 as I've said, that was based on information that we  
27 had when the application was written about two years  
28 ago. Since then we have completed the Inuvik snow  
29 road test. We have done other research and we are  
30 considerably more confident now than an earlier start



G.L. Williams  
Cross-Exam by Gibbs

1 can be achieved.

2 Q Than 1st of December?

3 A Than 1st of December.

4 Q Really I've got it back  
5 to, really as you've said I think it was two weeks ago,  
6 and that you just repeat it to late October?

7 A Right, or at the worst,  
8 the 1st of November; and if you take the 136 calendar  
9 days from the 1st of November, that puts you about  
10 the middle of March.

11 Q All right, I see, so  
12 that's where you get the slack or the extra time,

13 A The contingency time  
14 at the end of the schedule; and if there are only 80  
15 working days in that 136, as Mr. Gibbs suggests might  
16 happen, and I concede that it is possible in a very  
17 miserable year, then there are still 30 days at the  
18 end of the schedule in which to achieve the extra  
19 12 days.

20 Q So you're picking them  
21 up at the front end?

22 A Yes sir.

23 THE COMMISSIONER:

24 Yes, I recall now, I  
25 think we did discuss that. I'd forgotten.

26 MR. GIBBS: Excuse me, sir.

27 THE COMMISSIONER: Go ahead.

28 MR. GIBBS: Q Picking them  
29 up at the front end, meaning you're picking them up  
30 in the early part of the year rather than in the  
springtime.



G.L. Williams  
Cross-Exam by Gibbs

1 A We're saying, Mr. Gibbs,  
2 that we will start just as soon as we can.

3 Q Yes, so would everyone,  
4 but --

5 A No sir, Mr. Kosten did  
6 not say that.

7 Q All right, well then  
8 let's get to that point, since you're not prepared  
9 to tell me temperatures<sup>or</sup>/chill factors, but your 92 is  
10 a judgment, then let's take that commencement time,  
11 Mr. Williams. Behind you on the wall is the Foothills  
12 Pipe Line route map and on the north end is roughly  
13 similar to Arctic Gas. Can you point out there where  
14 spread number -- your northernmost spread will con-  
15 struct its 74 miles in the year 1?

16

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G.L. Williams  
Cross-Exam by Gibbs

1                                   A     Spread 1 in the first  
2 winter extends from the origin at the line at Taglu,  
3 Mile 0, to about Milepost 60, plus the Parsons Lake  
4 lateral.

5                                   Q     And does that cross what  
6 is called         Swimming Point?

7                                   A     Yes sir.

8                                   Q     And then, Mr. Williams,  
9 does spread 1 depend upon having road access to complete  
10 its 74 miles? Across Swimming Point.

11                                  A     Yes sir.

12                                  Q     Does it depend upon having  
13 a road across Swimming Point to start its construction  
14 of the 74 miles?

15                                  A     No sir.

16                                  Q     And will it then start  
17 from the south end and work north?

18                                  A     It will start from the  
19 north bank of the Mackenzie River at Swimming Point,  
20 work north to Taglu, the spread will then come back  
21 to Swimming Point by which time there would be an  
22 ice bridge across the east channel and it would  
23 proceed south from there.

24                                  Q     How does it get to the  
25 north bank to start? It would have to go across the  
26 river at Swimming Point, doesn't it?

27                                  A     No sir, that's where the  
28 camp is placed by barge in the summertime.

29                                  Q     And all of the equipment  
30 as well?



G.L. Williams  
Cross-Exam by Gibbs

1 A Yes sir.

2 Q And all of the men?

3 A No.

4 Q And the men are brought  
5 in by barge or air, I presume, as well.

6 A Very few by barge.

7 Q By air? I thought perhaps  
8 if you couldn't tell me what temperature they could  
9 work in, you might not perhaps be able to tell me how  
10 they got there.

11 MR. MARSHALL: Just your  
12 cattle go by barge.

13 MR. GIBBS: Well, the temper-  
14 ature you're going to work these people in, I wonder  
15 if they're treated like human beings.

16 Q Then, sir, is it necessary  
17 that you have a crossing at Swimming Point in order  
18 to do the first portion of your north spread in the  
19 first year?

20 A No sir, about  
21 25 miles can be constructed without a crossing of the  
22 east channel of the Mackenzie being required.

23 Q Are you aware of the gen-  
24 eral time of year when there is a road crossing at  
25 Swimming Point? A vehicle crossing?

26 A I don't have that date,  
27 Mr. Gibbs. I would guess it would be in the latter  
28 part of December.

29 Q And up until that time  
30 there is either open water or unsafe ice at Swimming



G.L. Williams  
Cross-Exam by Gibbs

1 Point?

2 A Yes.

3 Q And you are telling this  
4 Inquiry that that will not affect the operations of  
5 your northernmost spread at all.

6 A No, I certainly did not  
7 say that.

8 Q Well, will it?

9 A Certainly you can't move  
10 the construction equipment across south across the  
11 Mackenzie until an ice bridge is there unless you  
12 went to the expense of bringing in an air-cushioned  
13 vehicle.

14 Q And so you can't move  
15 equipment that construction south until, if it's a normal average  
16 year, after the 15th of December. Is that correct?

17 A Unless you had an air-  
18 cushioned vehicle, yes

19 Q And you don't propose  
20 to use air-cushioned vehicles for that purpose, do you?

21 A Oh, that's not excluded,  
22 no.

23 Q Well, sir, do you expect  
24 to move some of your construction equipment south  
25 across Swimming Point before December 15 in year 1?

26 A Oh, that's a detail that  
27 we haven't gone into, Mr. Gibbs. Possibly part of  
28 the spread could be on the south bank to install the  
29 smaller diameter Parsons Lake lateral. We really haven't  
30 worked out that detail.



G.L. Williams  
Cross-Exam by Gibbs

1 Q Well, isn't that a pretty  
2 significant detail in determining whether or not you  
3 can achieve your 74 miles?

4 A No, I don't think so.

5 Q Mr. Williams, in your  
6 92 total working days available, are you going to  
7 work your crews on the northernmost spread during  
8 other than total hours of working light?

9 A I'm sorry, would you  
10 repeat that, please?

11 Q Well, I'm reading, Mr.  
12 Williams, from your Exhibit 286 where the last column  
13 shown on -- under the page "Inuvik" is total hours  
14 of working light.

15 A Yes sir.

16 Q My question is whether  
17 in your 92 total working days available your crews  
18 are going to be working in hours other than total  
19 hours of working light.

20 A Yes, they will be.

21 Q They are going to be  
22 working in darkness.

23 A If artificial lighting  
24 were not used, it would be darkness, yes.

25 Q All right.

26 A They will not be working  
27 in darkness, no.

28 THE COMMISSIONER: Mr. Kosten  
29 said when he gave evidence that artificial lighting  
30 wouldn't work, it was not a practical scheme. I think



G.L. Williams  
Cross-Exam by Gibbs

1 I'm representing what he said fairly. You dispute  
2 that?

3 A Yes sir.

4 MR. GIBBS: Well, let's go  
5 into that dispute a little, Mr. Williams. What kind  
6 of operations will be carried on in your northernmost  
7 spread in the month of December in the first year?

8 A All pipeline operations.

9 Q All pipeline operations,  
10 including ditching?

11 A Yes sir.

12 Q Welding?

13 A Yes sir.

14 Q Coating?

15 A Yes sir.

16 Q Laying the pipe into the  
17 trench? Backfilling, and those operations are  
18 carried over, over a lengthy distance in miles, is  
19 that correct?

20 A Yes sir.

21 Q On an average day over  
22 what mileage length would you expect to have that  
23 northernmost spread covering in these various stages  
24 of operation? 20-25 miles?

25

26

27

28

29

30



G.L. Williams  
Cross-Exam by Gibbs

1 A No. If you include  
2 vehicular traffic, yes.

3 Q No, I don't include  
4 vehicular traffic. I was intending to start at the  
5 front end with the ditcher and at the back end with  
6 the backfill machine and what kind of mileage space  
7 in between?

8 A Oh, two to three.

9 Q Two to three miles.  
10 And during that mileage space, in between how many  
11 vehicles have you got or how many types of mobile  
12 machinery? How many units?

13 A In that two to three miles?

14 Q Yes.

15 A I don't have those  
16 figures with me. I can get them for you.

17 Q No, I don't want them  
18 exact. How many side booms have you got with carrying  
19 the pipe to lay it in the trench? How many welding  
20 vehicles have you got and so on? Can you give me an  
21 estimate of how many mobile units will be in that  
22 two to three miles?

23 A I could look at the orange  
24 volume here and probably come up with a number. I'm  
25 wrong, that's people, not equipment.

26 Q I was going to ask you  
27 about people so you might give me that number.

28 A In that two or three miles,  
29 how many pieces of moving equipment?

30 Q Mobile, ability to move



G.L. Williams  
Cross-Exam by Gibbs

1 equipment.

2 A Including rubber tired  
3 vehicles?

4 Q Yes, sir and tractor  
5 vehicles.

6 A I don't know, maybe 50.

7 Q And how many men? You've  
8 got that number.

9 A Close to 65 we show that  
10 crew of 706 people and of those, I suppose there could  
11 be up to 500 on the right-of-way.

12 Q And so, sir, in that  
13 two to three miles length--

14 A Don't hang me with these  
15 numbers now.

16 Q Well, I'm hoping to.

17 A Well, then, I take it  
18 back and I'm not going to answer the question until  
19 I have time to dig into the thing.

20 THE COMMISSIONER: Well, let's  
21 put it that the numbers are for the sake of argument.

22 MR. GIBBS: All right, sir.  
23 For the sake of argument then. Mr. Williams, in that  
24 two to three mile stretch at night in December you have  
25 some 50 vehicles and up to 500 men?

26 A How did you preface  
27 that?

28 Q I said in that two to three  
29 miles in December, at night, you have some 50 vehicles  
30 and about 500 men.



G.L. Williams  
Cross-Exam by Gibbs

1 A For the sake of argument.  
2 Those are the words I was looking for. Yes, sir.

3 Q The only point that is  
4 for the sake of argument is the number of men.

5 A No. And vehicles.

6 Q And vehicles?

7 A I'm just working off the  
8 top of my head here.

9 Q Yes, sir, I understand  
10 that and if it's 49 or 46 or 55, I'm not really  
11 concerned or if it's 450 men or 550. I'm trying to  
12 get at an order of magnitude of the traffic jam that  
13 is jammed into that two to three miles and we've got  
14 something like 50 vehicles and something like 500 men.  
15 Now, that's correct, isn't it?

16 A Well, in the context of  
17 the question and the chance that I've had to review  
18 the numbers. Sure.

19 Q And all are performing  
20 some particular task at any one time to do with getting  
21 the pipes into the ground and buried?

22 A Yes, sir.

23 Q And those activities in-  
24 clude the welding and the ~~wr~~apping and the ditching and  
25 the backfilling and everything else that has to be  
26 done all going on at the same time?

27 A Yes, sir.

28 Q And how do you propose to  
29 light that so that those people can work safely in the  
30 darkness?



G.L. Williams  
Cross-Exam by Gibbs

A With portable flood lights.

Q And how high are you going to have those flood lights and how many portable flood light units are you going to use?

A I have no idea. We haven't worked that out.

Q And in your experience, has there ever been an operation like that where you have Arctic cold, darkness and a traffic jam like that in two or three miles, working under artificial light?

A Certainly not in Canada. I don't know about the U.S.S.R. but there just haven't been any pipelines built in that condition in Canada.

Q No, sir, nowhere in your experience has that been done.

A Right.

Q And has there been any pipeline construction in Canada, in your experience, where they have worked in daylight hours in the winter in dark hours in the wintertime by artificial light performing all of the pipeline function?

A No, sir.

Q And don't you have to do that to get your 74 miles, Mr. Williams?

A Yes, sir.

Q And if safety factors are such that you cannot work in the hours of darkness, you are not going to get 74 miles. Isn't that a fact?

A If safety factors. Are



G.L. Williams  
Cross-Exam by Gibbs

1 these standards that you are speaking of?

2 Q No, Mr. Williams, you  
3 know what I mean when I say safety factors. Safe  
4 working conditions for men and equipment at night.

5 A I wouldn't propose to  
6 put people out there unless it were a safe condition.

7 Q All right, sir. Leave  
8 out the safety factors and say this, that if you cannot  
9 work in darkness, if your plan to use floodlights is  
10 not feasible, you cannot then make your 74 total miles  
11 in your northern most spread in year one, can you?  
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G.L.Williams.

Cross-Exam by Gibbs

1  
2 A I wouldn't consider that  
3 for a minute Mr. Gibbs. That is like there is no  
4 water in the north in the wintertime that we have had  
5 so many questions about, if this and if that. I won't  
6 buy that at all. In the present days when we have done  
7 so much, so many things with technology like putting  
8 men on the moon and a soft landing on Venus and the  
9 mulberry proposition of flood lay in a few miles of  
10 right-of-way, I don't see as a big deal at all.

11 Q Now, Mr. Williams, you are  
12 really not serious are you that--

13 A Yes, sir.

14 Q All right. Have you any  
15 equipment specifications to put forward before this  
16 commission showing the size, the candle power, the  
17 number of units, the location which will light that  
18 operation in those two or three miles to permit all of  
19 those operations to be conducted in what would otherwise  
20 be darkness?

21 A No, sir I haven't.

22 Q You don't know that it can  
23 be done, do you?

24 A Oh, there is no question  
25 in my mind whatsoever that it can be done, Mr. Gibbs.

26 Q It has never been done, has  
27 it?

28 A What has that got to do  
29 with it?

30 Q All right Mr. Williams.



G.L.Williams.

Cross-Exam by Gibbs

1  
2 If you can't do it, you cannot make your 74 total miles  
3 can you?

4 A That's right.

5 Q All right then. Now, sir  
6 you talked in your rebuttal evidence about what was  
7 being accomplished at Alyeska with artificial light.  
8 Do you remember that?

9 A Yes, sir.

10 Q And what they were doing  
11 in Alyeska with artificial light was essentially a  
12 stationary construction.

13 A No, I tried to point out  
14 that it really wasn't.

15 Q I see.

16 A They had lots of mobile  
17 equipment in there, a lot of swinging equipment.

18 Q But in effect what they are  
19 doing is raising towers which are sitting in one place?

20 A Well the equipment still  
21 has to move around and there a lot of people there.

22 Q Oh, yes. It has to move  
23 around the base or the working area, but it is certainly  
24 nothing like your two to three miles with fifty pieces  
25 of equipment and something like five hundred men, is it?

26 A I think that there is a  
27 reasonable comparison. Those flood lights are on rubber  
28 tired vehicles that can be moved. I don't see a big  
29 problem there.

30 Q Did you witness that operation?



G.L. Williams.

Cross-Exam by Gibbs

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A Not, in hours of darkness,  
no. I was there in the summertime when there was very  
little darkness, but the operation is still going  
on now, when there are many hours of darkness.

Q And is it being carried on  
in the hours of darkness?

A Yes, sir.

Q And when you were there in  
the daylight, Mr. Williams, how many vehicles--? Let's  
take just one of them and those operations were the  
raising of standards upon which saddles would be placed  
to carry a pipeline, wouldn't they?

A That was one part of it.

Q What other parts?

A Drilling the holes, hoisting  
the piles, they had concrete trucks mixing slurry to  
backfill the piles, a vibrator to, a piece of equipment  
with a vibrator on it to consolidate the slurry, an  
expander, and expanding device that was inserted in the  
pile after it was in place to corrugate the bottom end  
of it, air compressors to run the drilling equipment,  
other transport vehicles.

Q And can you tell the  
Commissioner what of those various operations you have  
been describing as carried on in darkness by Alyeska?

A All of those operations.

Q Have you been there to see  
those operations being carried on in darkness?

A No, sir.



G.L. Williams.  
Cross-Exam by Gibbs

1  
2 Q Do you have a report that  
3 you can show us to say that these are the things that  
4 are done during the hours of darkness under artificial  
5 light?

6 A No, sir. Just discussions  
7 that I had with the contractors.

8 Q All right.

9 A One operation cannot go  
10 on without completing it. All of those operations have  
11 to be done or it is not worthwhile starting.

12 Q Sure and they can all be  
13 done in the daylight can't they Mr. Williams?

14 A Yes and they were doing  
15 them in the daylight.

16 Q And perhaps they do most  
17 of them in the daylight and some selected ones at night?

18 A No, I don't think so sir.

19 Q But, you don't know. You  
20 haven't witnessed it. You have no written report to  
21 show us that that's not the case.

22 A I have discussed the matter  
23 with contractors.

24 Q Mr. Williams I put this to  
25 you. That if your scheme of using illumination to  
26 carry out the activities in your two to three mile  
27 traffic-jam does not work--

28 MR. MARSHALL: Well that's his  
29 idea of what may going on, fifty vehicles over two or  
30 three miles.



G.L. Williams.  
Cross-Exam by Gibbs

1  
2 Q Well surely he knows--  
3 Well he sat here on the seventeenth of October and told  
4 us that this was possible and he is an experienced  
5 man--

6 MR. MARSHALL: The traffic-  
7 jam was your idea.

8 THE COMMISSIONER: Well that  
9 was a phrase that Mr. Gibbs has used but I am not being,  
10 I am not assuming it's a traffic-jam, but I am  
11 assuming there are a fairly large number of vehicles,  
12 perhaps 50. That's all Mr. Williams is saying.

13 Q All right I thought  
14 traffic-jam was a good generic term but if, let's use  
15 this fact, that if your plan to work something of the  
16 order of 50 vehicles and something of the order of  
17 500 men in a two or three miles space in December by  
18 artificial light does not work, then I put it to you that  
19 the Foothills estimate of 45 total miles in a season for  
20 the northern-most spread could well be reality compared  
21 to your 74?

22 A Well, it is a pretty short  
23 season, Mr. Gibbs, if your not going to start until the  
24 first of February.

25 Q Well, that's not what I  
26 asked you Mr. Williams. I did not ask him to  
27 start at the first of February. I put the proposition  
28 to him using his own time schedule. There is no need  
29 from him to say, "if you start the first of February.."  
30 I am letting start when he wants to start, when it is



G.L. Williams.  
Cross-Exam by Gibbs

1  
2 practical to start.

3 MR. MARSHALL: Your dealing  
4 with the Foothills estimate that's based on starting  
5 on a particular time, giving a certain amount of  
6 calendar days and from that a certain amount of working  
7 days and your dealing with a totally different starting  
8 date and hence a totally different number of calendar  
9 days and working days for the Arctic Gas proposition.  
10 they're apples and oranges.

11 MR. GIBBS: Let me put the  
12 proposition to him again and I am taking it from his  
13 own exhibit, 285. If your plan, Mr. Williams, to  
14 have something of the order of 50 mobile units and  
15 something of the order of 500 men working in December,  
16 at night, in a two to three miles space, by artificial  
17 illumination does not work, I put it to you that it  
18 could well be that the Foothills estimate of 45 miles  
19 for that northern spread could be closer to actual than  
20 your 74. Now I am inviting you to agree with me.  
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G.L. Williams  
Cross-Exam by Gibbs

1 A Not with the schedule  
2 as put forward by Mr. Kosten, I would not agree.

3 Q Let's leave aside the  
4 schedule.

5 A How can you do that?

6 Q All right then, sir,  
7 let me start again. If your plan to put -- to have  
8 50 mobile units and upwards of 500 men working in a  
9 two to three-mile length in your northernmost spread  
10 in December, at night, by illumination, doesn't work,  
11 you may accomplish not 74 total miles in that season  
12 but only 45. Now, do you agree with that?

13 A No, I wouldn't reduce  
14 it that much.

15 Q Why not, sir?

16 A Because we are planning  
17 to start as soon as we can in November when the  
18 daylight is better and to work all of the month of  
19 January when there is a fair bit of daylight, and as  
20 well as February, March, and we still have some cushion  
21 at the end. If the proposition of artificial lighting  
22 does not work -- and I won't concede that at all -- but  
23 just to go along with your supposition, if it doesn't  
24 work there would be a reduction, I would think, in  
25 the number of miles.

26 Q And it could well be  
27 as from 75 down to 45, couldn't it?

28 A No, I don't think so,  
29 Mr. Gibbs.

30 Q Well, sir, the reason I



G.L. Williams  
Cross-Exam by Gibbs

1 suggest that to you is I'm looking at your own  
2 Exhibit 286 and I'm looking at the page,

3 "Working light in Inuvik,"  
4 and if you look at the total hours of working light  
5 you find on November 1st, 8.1 as compared with the  
6 24 you would have if you could work all night long.  
7 I'm sorry, yes, 24.

8 A I've never talked about  
9 working all night long, and I should have checked you  
10 a minute ago when you talked about working in the  
11 night. We're not working in the night, we're working  
12 in hours of little daylight.

13 Q Well, you're working in  
14 hours other than total hours of working light. That's  
15 correct, isn't it?

16 A Not at night-time, no.

17 Q I'm sorry, well then --

18 A What is night-time?

19 Q All right then, let's  
20 go back to November 1 and tell me on that day what  
21 hours your crews will be working?

22 A If it was restricted to  
23 the total hours of working light, the table said it  
24 would be 8.1 hours at the 1st of November.

25 Q But Mr. Williams, accord-  
26 ing to your plan you're going to illuminate some of  
27 the dark hours.

28 A Right.

29 Q And so on November 1  
30 in year 1 on your northernmost spread, how many hours



G.L. Williams  
Cross-Exam by Gibbs

1 are you going to work if your illumination plan works?  
2 How many working hours in that two to three miles?

3 A Oh, working hours, about  
4 10, Mr. Gibbs.

5 THE COMMISSIONER: That is the  
6 eight hours of daylight, for example, on November 1st,  
7 at Inuvik on November 1st, eight hours of working  
8 light, according to this Smithsonian Institute, plus  
9 10 beyond that, is that the situation?

10 A No, just plus 2, sir.

11 Q So you're really going  
12 to have one shift?

13 A Oh yes.

14 Q Well then, when you get  
15 to January 1st, which is the middle of winter, there  
16 are no hours of daylight in Inuvik, 2.6 hours of  
17 civil twilight, 2.6 hours of working light, so you're  
18 going to work 2.6 plus --

19 A 7.4

20 Q -- 7.4 under lights.

21 A Yes sir.

22 MR. GIBBS: Well, I haven't  
23 worked out those averages, Mr. Williams, but at a  
24 glance it would look as if you've got some, between  
25 November 1 and March 1, something close to 50% of  
26 the hours are not hours, total hours of working  
27 light.

28 A That looks reasonable.

29 Q So then if your plan to  
30 use the illuminating devices for the hours which are



G.L. Williams  
Cross-Exam by Gibbs

1 not total hours of working light doesn't work, you  
2 could well cut your 75 total miles in half and it  
3 would be less than 45.

4 A No. You just took part  
5 of the construction year.

6 Q I thought you were going  
7 to start up there around November 1.

8 A Yes sir.

9 Q And finish around March 1.

10 A No, no. I said if you  
11 start November 1 and you require 136 calendar days,  
12 that would be the middle of March. If you're not  
13 finished then you still have another month to complete  
14 it.

15 Q Well then, I missed two  
16 weeks there, and that would change the 50% somewhat,  
17 and it may bring it up to the 45 total miles instead of  
18 75.

19 A We still have another  
20 month beyond that, Mr. Gibbs.

21 THE COMMISSIONER: Can I just  
22 ask a question, Mr. Williams?

23 Q This thing says that  
24 December 1st you have 4.1 total hours of working light  
25 at Inuvik, so the two spreads in the vicinity of  
26 Inuvik would come under this. It goes down until  
27 January 1, you have only 2.6 hours and then you're  
28 back<sup>up</sup>/to 5.8 hours by January 25th. So that you have  
29 two months from December 1st to February 1st in which  
30 your crews would on the average not even be working



G.L. Williams  
Cross-Exam by Gibbs

1 half a shift unless you had a scheme for artificial  
2 light. That much / <sup>seems</sup> plain enough.

3 A Yes sir.

4 Q Now, when you got those  
5 estimates from the eight or nine pipeline contractors,  
6 about the mileage per spread that they could achieve  
7 working from December 1st till April 15th, was it  
8 put to them that artificial lighting would be required  
9 during the first two months, if they were to get in  
10 more than half a shift? Was that considered by them so  
11 far as you know?

12 A Yes sir. Yes, it was  
13 definitely discussed in our meetings with them before  
14 they gave us estimates.

15 Q But none of them obviously  
16 would have ever run an operation artificially lighted  
17 in that way.

18 A Not for a complete  
19 construction spread. Some parts of it they certainly  
20 had experience with artificial lighting. But I hope that  
21 with Mr. Gibbs' question we haven't suggested that  
22 artificial lighting is required on two to three miles  
23 of right-of-way. He asked how far the spread was  
24 scattered out. Now take a ditching machine that's up  
25 on the front end, it has its own lights, like a vehicle  
26 only more so. It generates its own power so it has  
27 sufficient light to operate. Ditching is done on the  
28 prairies often on a double shift basis around the  
29 clock. There is nothing new about ditching in darkness.

30



G.L. Williams  
Cross-Exam by Gibbs

1 THE COMMISSIONER: Can I  
2 interrupt, Mr. Gibbs, again for a moment to ask when  
3 they built the Canol pipeline, that was regarded as  
4 essential to the war <sup>effort</sup> by Canada and the United States.  
5 They built it in sub-Arctic conditions at least if not  
6 Arctic conditions. Is there any record of whether  
7 they worked beyond the total hours of working light in  
8 the middle of winter? Is there any record of the  
9 accidents they had? Whether there were casualties on  
10 the line?

11 Those are things they  
12 might have ignored in those days because it was essen-  
13 tial to the war effort and people were being killed  
14 overseas to win the war and no doubt, it would have  
15 been thought that people should have been willing to  
16 risk their lives on a civilian project. It was an  
17 army project, but at least no one was shooting at them.

18 Did you people assemble  
19 anything from the Canol line? At least, or anything  
20 that would assist so far as you know?

21 A Mr. Hemstock has written  
22 an excellent paper on the operation of the Canol  
23 pipeline. Now I have forgotten how much that paper  
24 dealt with the construction of it, Mr. Commissioner,  
25 but my recollection is that probably most of that was  
26 built in the summer months rather than winter months  
27 when there was -- it was built in the summer when there  
28 was lots of daylight, I think. It was certainly opera-  
29 ted through the winter months. One winter season  
30 anyway.



G.L. Williams  
Cross-Exam by Gibbs

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Q Yes, but  
you say the Canol line was built in the summer months  
as far as you know?

A I'm fairly sure about that.

Q You see, here we have one  
pipeline company, Arctic Gas that says we can start  
before November 1. We can get our snow roads in. We  
can work in the dark. We can establish an artificial  
lighting system that will enable us to get in two or  
even three months of work before February 1.

The other pipeline company  
Foothills, taking a more conservative approach says, "No  
we can't. We're not at all certain we can build the  
snow roads in time. We believe we cannot work in the  
dark without an unacceptable accident rate and so we  
won't begin until February 1." This is a vital difference  
of opinion, not only to the Inquiry and to the  
government but to Arctic Gas, because if it turns out  
you people build a pipeline, <sup>is</sup> that/ if Arctic Gas builds  
a pipeline and if Foothills is right about snow roads  
and about artificial lighting then you won't build this  
thing in three years. It may take four or even five.  
The meter will be running on the interest, on the  
borrowing and the cost will go up even more.

And you will appeal to the  
you know, to Technology with a capital T, the man on  
the moon and so on, but someone like Mr. Gibbs could  
collonade disasters that technology has had. It has  
had failures.

And when they send a man



G.L. Williams  
Cross-Exam by Gibbs

1 to the moon the whole of the United States' technology  
2 was brought up there and one would guess that they  
3 left. There wasn't a major difference of opinion as  
4 we are encountering here.

5 You may say well, Mr.

6 Kosten and Mr. Jarvis who are the two men lined up  
7 against you on the other side on behalf of Foothills,  
8 well they don't know what they are talking about, or  
9 they have only a limited understanding of all of this,  
10 but there it is. For the Inquiry, we have got this  
11 difference of opinion. You take a, what many would call  
12 a radical approach. The others take a conservative  
13 approach.

14 And if you are wrong, as  
15 you say, that this has never been done in Canada, you  
16 don't know if it has been done in the Soviet Union,  
17 then it is pretty serious. Well, anyway, carry on,  
18 Mr. Gibbs.

19 MR. GIBBS: Q At this  
20 point, Mr. Williams, although you had evidence from  
21 advice from the pipeline contractors, have you had  
22 any conversations with the unions which will be  
23 involved about whether they will permit their people  
24 to work under those conditions?

25 A No, sir.

26 THE COMMISSIONER: Well, that's another  
27 point. You see, within the pipeline guidelines if you  
28 look at them. It seems to me that I'm supposed to  
29 make recommendations about the selective agreements  
30 that eventually will be signed if the pipeline is built



G.L. Williams  
Cross-Exam by Gibbs

1 between the pipeline companies and the unions that  
2 represent the construction crew. Foothills has said  
3 that the unions will insist that there will be a  
4 minimum temperature, or maximum. I'm not quite sure how  
5 you would put this but if the temperature gets below  
6 a certain level, the men cannot be required to work and  
7 regardless what the agreement says, they may decide  
8 not to work anyway. Regardless what I recommend,  
9 regardless what the union representatives sign. They  
10 might say, we're not working today. It's too cold.

11 And for causes less  
12 serious than that construction crews have been known  
13 to refuse to work.

14 Everything seems to depend  
15 on this in many ways. It is a very important matter.

16 A Well as I have said,  
17 Mr. Commissioner, I have made such analysis at Prudhoe  
18 Bay where the -- where Battelle who operated the test  
19 facility at that site kept an excellent record of  
20 weather conditions unfortunately, it was just over a  
21 period of a year and a half.

22 Using their records for  
23 that year and comparing it to long term records, at  
24 Barter Island, I did come up with an analysis that  
25 showed that you could withstand many weather days and  
26 this was based on temperature and wind velocities and  
27 still meet the schedule.' The -- I think the working  
28 season is perhaps a little -- the winter working season  
29 is a little longer there, like from the first of  
30 October to the first of May. In Inuvik it is probably



G.L. Williams  
Cross-Exam by Gibbs

1 more like the fifteenth of October to the fifteenth of  
2 April, but I feel that the key to meeting the schedule  
3 is get in as early a start as possible. And work in  
4 all the days that are available.

5 THE COMMISSIONER: Q Well,  
6 everybody would agree with that.

7 A Well --

8 Q But if during the first  
9 year or your second year, there is an unacceptable  
10 accident rate working under lights. Unacceptable  
11 perhaps to the government, to the regulatory authority  
12 whatever it may be, unacceptable to Arctic Gas,  
13 unacceptable to the union, unacceptable to the con-  
14 struction crews and then you are in trouble. That's  
15 And I appreciate that you are doing your best to  
16 assist us here. We're trying to predict what will  
17 happen. It isn't easy. Go ahead. Sorry to interrupt  
18 you so often.

19 MR.GIBBS: Q All right, sir.  
20 In your down-time at this northern most spread, Mr.  
21 Williams, do you include any total down-time over the  
22 Christmas period?

23 A It takes care of a short  
24 Christmas break, Mr. Gibbs.

25 Q How long?

26 A We would still hope to  
27 maybe accomplish some work even in that period.

28 Q How long is your short  
29 down-time for Christmas?  
30



G.L. Williams  
Cross-Exam by Gibbs

1  
2 A Oh I think it is five or  
3 six days.

4 Q And in your experience,  
5 Mr. Williams, is that a normal Christmas down-time on  
6 a construction of this nature?

7 A Oh, what's normal, Mr.  
8 Gibbs? I've worked in the Swan Hills in the early days  
9 of the development there and I think I got home for  
10 a couple of days at Christmas and maybe a couple of  
11 days at New Year and the contractors, the people who  
12 were working there did about the same. I don't  
13 know what that was twelve, thirteen years ago. I  
14 don't know if that's normal now, but I think that there  
15 are people that will work through the Christmas season.

16 Q All right, sir, then let's  
17 now come down to the other end of your working light  
18 exhibit, Fort Simpson.

19 And the time at which you  
20 were able to commence operations that is, ditching,  
21 in your spread that's working in the Fort Simpson  
22 area what date by which -- by what date do you expect  
23 that to commence in year one?  
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G.L. Williams  
Cross-Exam by Gibbs

1                   A     In areas south of Fort  
2 Simpson there is a problem because of the deep muskeg  
3 that is there. It's going to take a while to get  
4 enough frost induced into the muskeg to allow the  
5 passage of heavy construction equipment, and I wouldn't  
6 expect that much actual construction would start  
7 before the last week in November.

8                   Q     Yes, and that depends,  
9 Mr. Williams, on your ability to have your snow roads  
10 constructed by the last week of November.

11                  A     Yes sir.

12                  Q     And your ability to  
13 construct snow roads by that time depends upon the  
14 frost depth by the last week in November? That's  
15 one of the things it depends upon?

16                  A     Yes sir.

17                  Q     And another that it  
18 depends upon is the snow depth?

19                  A     In muskeg terrain I don't  
20 think that's a serious consideration, Mr. Gibbs.

21                  Q     I thought I had read  
22 your evidence to say that in deep snow it was an  
23 insulator, so you would have to pack it down to induce  
24 freezing.

25                  A     I'm sorry, I read you  
26 a different way, that you needed a bunch of snow  
27 before you could get started, and I'm talking about  
28 south of Simpson, now, in the muskeg boggy zone.

29                  Q     The area covered by your  
30 working light at Fort Simpson, Exhibit 286.



G.L. Williams  
Cross-Exam by Gibbs

1 A Well, a very short  
2 distance north of Simpson we have a situation that's  
3 substantially different, Mr. Gibbs, because there is  
4 not vast stretches of muskeg.

5 Q All right, let's take  
6 your area south of Fort Simpson then, where you need  
7 frost depth, where it depends on frost depth and it  
8 depends on snow depth, your ability to start your  
9 heavy equipment working by the last week of November.

10 A Well, as I say, I don't  
11 think snow depth is a big consideration. Now you said  
12 that you needed -- that snow acted as an insulator.  
13 I'm sorry, I'm a little mixed up.

14 Q Well, you said on October  
15 17 that if there was a heavy snowfall it would act as  
16 an insulator so you'd have to compact it in order to  
17 induce the frost to penetrate deep enough to carry  
18 heavy vehicles.

19 A Yes sir.

20 Q So that your ability to  
21 start heavy vehicular work in the last week of November  
22 turns in part on frost depth, which in turn turns on  
23 snow depth. If there's not much snow, the frost is  
24 down; if it's thick you may have to compact it.

25 A Yes, but I don't see  
26 that delaying things appreciably, Mr. Gibbs.

27 Q I haven't yet got to the  
28 delay point. Those two factors are significant in  
29 your ability to construct your snow roads. Isn't that  
30 a fact, Mr. Williams?



G.L. Williams  
Cross-Exam by Gibbs

1 A Yes, a substantial snow-  
2 fall in September would be -- that stayed would present  
3 some problems, yes, sir.

4 Q Yes, so for purposes of  
5 frost depth you hope that there's a very light snowfall  
6 at least up until the middle of November, or no snow-  
7 fall at all. Is that right?

8 A That would be conducive  
9 to frost penetration, yes.

10 Q But on the other hand  
11 in order to build those snow roads you need some snow  
12 to make the road up.

13 A Well, that was the point  
14 I was making earlier. In the muskeg area I don't think  
15 this is a requirement.

16 Q Snow to build the road?

17 A Yes.

18 Q Oh, I was under the  
19 impression one of the reasons why you built up a snow  
20 level was to avoid damaging the surface of the ground.

21 A North of Fort Simpson,  
22 yes, Mr. Gibbs. I put the area south of Fort Simpson  
23 similar to Northern Alberta conditions, where there  
24 are also vast stretches of muskeg, and snow road  
25 construction, as we were speaking of it in the context  
26 of the Inuvik snow road test, in my opinion, doesn't  
27 apply to the area south of Fort Simpson.

28 Q Do I take it then that  
29 over the muskeg area you wouldn't propose to put any  
30 cover over the surface, you feel that when the frost



G.L. Williams  
Cross-Exam by Gibbs

1 is in you can just use it like an ordinary road.

2 A In the muskeg terrain, yes.

3 Q I see. Well then, in  
4 what terrain do you, in your view, need to build up a  
5 snow cover for / <sup>the</sup> vehicles to travel on?

6 A In the sensitive permafrost  
7 area where it's important to protect the vegetation  
8 cover.

9 Q And does any of that occur  
10 in the working light at the Fort Simpson area covered  
11 by page 1 of Exhibit 286?

12 A North of Fort Simpson,  
13 yes; to a much lesser extent, south of Fort Simpson.

14 Q All right then, north of  
15 Fort Simpson you need frost depth and the depth to  
16 which the frost has penetrated by the last week of  
17 November is governed by some degree by the amount of  
18 snow cover?

19 A Yes.

20 Q And if the snow cover  
21 is minimal, you've got a greater frost depth than  
22 if it's deep?

23 A Oh, that doesn't  
24 necessarily follow. That depends on how quickly you  
25 can get out and compact the snow and reduce or increase  
26 the thermal conductivity.

27 Q But without compaction  
28 of the snow, if there's heavy snow cover, frost will  
29 not penetrate as it will if there is no, or a light  
30 snow cover. Isn't that right?



G.B. Williams  
Cross-Exam by Gibbs

A That's right.

Q Yes, but then you want some fairly heavy snow cover at some time before the end of November, so that you can build up the thickness of your snow road.

A In the sensitive permafrost zones, yes

Q And I take it that you anticipate that there will not probably by the end of November be enough snow on the snow roads right-of-way, that you will have to obtain snow from elsewhere to build up the necessary thickness.

A In the sensitive areas,  
in some areas, not all areas.

Q And you expect to borrow that snow from somewhere else other than the right-of-way.

A Or manufacture it on  
the right-of-way.

Q Well, to the extent you expect to borrow, where are you going to borrow it from?

A From mostly from frozen  
water surfaces.

Q And what kind of equipment are you going to use to gather up that snow on the frozen water surfaces?

A Oh, some kind of a vehicle  
with a blade on it and put it in a windrow.

Q I understood your evidence,



G.L. Williams  
Cross-Exam by Gibbs

1 Mr. Williams, to say that in this area that we're  
2 speaking of you would want to have at least eight  
3 inches of frost depth before you, underneath your  
4 compacted snow on your snow road, before you put heavy  
5 traffic on top.

6 A In a mineral soil  
7 situation,

8 Q Yes, and am I right  
9 in saying that before you would put heavy equipment  
10 onto an ice area you would want to have somewhere in  
11 the range of over 12 inches of ice to support those  
12 vehicles?

13 A Oh, it depends on the  
14 body of water, Mr. Gibbs. If it's a shallow body of  
15 water and you're working around the edge, you might  
16 get by with a bit less than that but that's a fair  
17 number, yes.

18 Q And would you expect on  
19 your water areas to have 12 inches or more of ice at  
20 the same time as you've got 8 inches or thereabouts  
21 of depth of ice in the soil?

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Williams.  
Cross-Exam by Gibbs

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A If you had not compacted the snow on the right-of-way, it might happen about the same time. If you had compacted I would expect you would get the eight inches of frost penetration on the right-of-way before the twelve inches of ice on the ponds.

Q So, another factor in your snow road construction is the thickness of ice on the lake or slough areas where you are going to borrow snow?

A If that was the means that you chose to thicken your snow cover as opposed to snow manufacture.

Q And that the other features you suggested snow manufacture.

A Yes, sir.

Q How do you propose to go about manufacturing snow?

A Well I am sure we have been through this several times in the evidence, Mr. Gibbs.

Q Well, just tell me what you propose to do to manufacture snow. If your going to tell me it is the kind of unit they use on ski slopes, I will be content with that.

A Yes, it is-- There are improvements being made and we are working with manufacturers of ski-hill equipment to adapt their equipment to our proposed use and--

THE COMMISSIONER: I hope it is



Williams.  
Cross-Exam by Gibbs

1  
2 not the one they use on Grouse Mountain in Vancouver.

3 MR. GIBBS: Well, sir that's  
4 what I was getting to. Not Grouse Mountain but--  
5 Mr. Williams, do you really seriously suggest that a  
6 snow manufacturing machine such as the type that's used  
7 on ski slopes would provide any substantial quantity  
8 of snow for building snow roads?

9 WITNESS WILLIAMS: Yes.

10 Q Then how many of these  
11 machines, how many days? Do you have any figures to  
12 indicate what your going to have to mount to get any  
13 quantity of snow for snow road building?

14 A Yes, we have gone through  
15 that exercise. I don't have it here with me.

16 Q Is there an exhibit marked  
17 to your recollection that shows this?

18 A No, sir.

19 MR. MARSHALL: There is a  
20 substantial amount of evidence in the transcript where  
21 there was exhaustive cross-examination on this subject  
22 including that by Foothills.

23 MR. GIBBS: I suggest to you  
24 that the practical use of snow manufacturing machinery  
25 is not for construction but for subsequent mainenance?

26 WITNESS WILLIAMS: No, sir,  
27 I don't see it as a mean's of constructing many miles of  
28 snow road, but I see it as a means of assuring an early  
29 start in a year, an early construction start on a right-  
30 of-way in a year of low snowfall because, in my opinion



Williams.  
Cross-Exam by Gibbs

1  
2 that when you have your equipment at a future compressor  
3 station site and you have a few miles of snow road  
4 and right-of-way snow cover prepared, that construction  
5 can start. That in the initial stages you don't need  
6 a high-speed haul road to start construction.

7 Q Well Mr. Williams, as well  
8 as the frost depth, the ice depth, the snow depth on  
9 that  
10 the lakes/ you are going to borrow snow from, don't  
11 you face the potential problem of open water in areas  
12 where the snow road or your equipment road is going to  
have to cross water?

13 A Yes, sir.

14 Q And that's another factor  
15 that would affect the start up date of late November?

16 A No, I don't think so.

17 Q Well, I am told, for  
18 example, that last year the Department of Public Works  
19 was held up at a crossing at Fort Simpson for some  
20 weeks because of open water. Are you aware of that?

21 A Was this to get across the  
22 Mackenzie River?

23 Q Yes, and are you aware of  
24 that?

25 A I don't remember being told  
26 about it but I can certainly believe it.

27 Q Well isn't that a factor  
28 which could affect your proposed commencement of  
29 operations date of late November?

30 A No, sir. I don't think so.



Williams.  
Cross-Exam by Gibbs

1  
2 Q And why not?

3 A I think with proper  
4 planning that work can proceed without that being a  
5 probelm. For instance, the Mackenzie, there is no way  
6 your going to have to wait, hold up construction  
7 waiting for an ice bridge across the Mackenzie. That  
8 would be bum scheduling if you did that. You can work  
9 both directions from the campsite. For small stream  
10 crossings that aren't frozen, Bailey<sup>bridges</sup> can be put  
11 across to move the equipment across. You don't have to  
12 construct a crossing if it is not environmentally, not  
13 an environmentally proficious time to do it in the early  
14 part of the year, it can be delayed. There are many  
15 things that can be done and will be done to get around  
16 these problems. A lot of planning / scheduling is  
17 certainly required.

18 Q Mr. Williams, in the spread  
19 covered by your working light at Fort Simpson a  
20 sheet on exhibit 286. How many miles of snow road or  
21 access road, including snow road, are you going to have  
22 ready to carry heavy equipment by late November in your  
23 first construction year?

24 A Would you like to look  
25 at a specific spread?

26 Q Oh, you can tell me whether  
27 it is likely to be five miles or ten miles or one mile.  
28 Give me a range of what you expect to have done? I  
29 appreciate you can't give me precise figures.

30 A Well, I think if you have



Williams.  
Cross-Exam by Gibbs

1  
2 four or five miles of right-of-way properly prepared,  
3 you can start construction Mr. Gibbs.

4 Q All right. And would you  
5 expect, Mr. Williams, that your contractor is going to  
6 bring his crew and his equipment in to start work in  
7 the middle or end of November with only four or five  
8 miles of road ready? Surely he is going to want to  
9 see substantially more than that before he mounts a  
10 tremendous lift of people and machinery into your  
11 spread area.

12 A No, I don't see that problem.

13 Q And you don't see that  
14 contractor being apprehensive that weather conditions  
15 might hold up the construction of more snow roads and  
16 he is left with men and equipment idle on his hands in  
17 low temperatures?

18 A I imagine this would--  
19 At least a substantial part of it would depend on the  
20 type of contract you had, Mr. Gibbs.

21 Q Well, I suggest to you, sir,  
22 that the pipeline contractors are going to be working  
23 on this northern project, are going to be extremely  
24 reluctant to bring in that massive amount of men and  
25 equipment until most of the road, access road, for their  
26 spread area is ready for use. Now do you agree or do  
27 you not agree?

28 A I disagree.

29 Q All right, sir. Now, Mr.  
30 Williams, who established the productivity schedule for



Williams.  
Cross-Exam by Gibbs

1  
2 productivity forecast for the Arctic Gas construction  
3 program? Was it the Arctic Gas management and the  
4 development then being that you and the contractors have  
5 to meet it or did you establish it and was it adopted  
6 by Arctic Gas management?

7 A Oh, the schedule was the  
8 work of many, many people Mr. Gibbs. I think the--  
9 As you know, there was a staff at Arctic Gas and still  
10 is of course, there was continual meetings between the  
11 staff of Northern Engineering and the staff of Arctic  
12 Gas and discussions with the contractors. I think that  
13 Northern Engineering had as much input into the  
14 schedule as adopted as any particular group.

15 Q Well, Mr. Williams I put  
16 it to you this bluntly. That the production rates for  
17 the construction spread ultimately were determined  
18 by Arctic Gas management and you and the contractors  
19 are being put to the task of meeting those production  
20 rates. Is that so, or is it not so?

21 A That is not so.

22 Q Those are all of my questions

23 THE COMMISSIONER: Well, I  
24 think that is as far as we have to go this evening. I  
25 don't think I will ask the panel to come back and carry  
26 on because it is quarter to ten.

27 MR. SCOTT: I have one or  
28 two questions to ask Mr. Williams. Should I do it in  
29 the morning sir?

30 THE COMMISSIONER: No, I thought



Williams.  
Cross-Exam by Gibbs

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you wanted to leave in the morning. That is Mr.  
Williams.

MR. SCOTT: Well let me just  
see if I understand Mr. Williams, if we are ready to  
proceed, if I know what has been talked about.



G.L. Williams  
Cross-Exam by Scott

1 CROSS-EXAMINATION BY MR. SCOTT:

2 Q I take it that your  
3 plan in dealing with the first spread at Inuvik is  
4 to begin hopefully on November 1st and run until  
5 April 15th. Have I got that right?

6 A Well, not quite, Mr.  
7 Scott.

8 THE COMMISSIONER: The con-  
9 tractors say they can do that from December 1st to  
10 April 15th. Mr. Williams has since that time those  
11 estimates were obtained reached the conclusion that  
12 snow roads can be built to enable construction to  
13 begin even before November 1st, giving them an extra  
14 month. That's what I understand.

15 MR. SCOTT: Q But, Mr. Williams,  
16 what I'd like to do is see if we can discuss this  
17 just for a moment without reference to work days,  
18 which is the principal question on which Mr. Gibbs  
19 directed most of his questions at the beginning and  
20 do I understand that it is your, perhaps optimistic,  
21 as he thinks, expectation that you may be able to  
22 begin about November 1st?

23 A In the Inuvik area, yes,  
24 I would hope earlier than that, Mr. Scott.

25 Q Well all right, let's  
26 take November 1st --

27 A Yes sir.

28 Q -- and I take it that  
29 you say that you hope you will be able to run until  
30 April 15th or thereabouts, if necessary.



G.L. Williams  
Cross-Exam by Scott

1 A Well, it's hard to  
2 answer that without discussing working days.

3 Q Let's not talk about  
4 working days, let's talk about working periods and  
5 I take it that your expectation, for better or for  
6 worse, is that about November 1st you <sup>should</sup> be able  
7 to start and it will not be until April 15th that  
8 you will have to abandon the section,

9 A Yes.

10 Q All right. Now, Foothills  
11 evidence was that they would begin spread 1 on what  
12 date?

13 A Oh, I have several  
14 references here to what they said, but generally it  
15 was the late January or the 1st of February.

16 Q All right. Well now, was  
17 there any evidence that you recall -- I don't have  
18 my notes at the moment -- which suggested that they  
19 could work on the site longer than April 15th?

20 A Yes.

21 Q In short, was their  
22 cutoff date about the same as yours?

23 A No, I think it was April  
24 30th.

25 Q All right.

26 A Because they talked about  
27 90 days beginning the 1st of February.

28 Q All right, well let's  
29 take it this way then. You were going to have -- if your  
30 expectations are correct -- about 5 1/2 months over



G.L. Williams  
Cross-Exam by Scott

1 which you anticipated doing, what was it, some 76 miles  
2 in that spread?

3 A Yes.

4 Q And they were going to  
5 have some three months over which they would do 46  
6 miles.

7 A 44 1/2, yes.

8 Q Yes, and I take it that  
9 those proportions --

10 A Plus the Parsons Lake.

11 Q Well, I'll come to the  
12 Parsons in a moment.

13 A Yes.

14 Q But those proportions  
15 without working them out are roughly the same, aren't  
16 they?

17 A Yes.

18 Q All right. Now, the  
19 evidence also was, as I understand it, that Foothills  
20 was going to do some 22 other miles, I think I have  
21 the figure right, on the Parsons lateral. Is it 22  
22 or 27?

23 A I thought it was more  
24 like -- ours is 14.7, I think -- I thought theirs was  
25 about the same. I'm not sure.

26 Q All right, well let's  
27 take it at its minimum figure and let's say 20.

28 MR. GIBBS: Oh no, the minimum  
29 figure the witness said 14.

30 MR. SCOTT: I'm sorry, did you



G.L. Williams  
Cross-Exam by Scott

1 say 14? All right, let's say 14 and we'll add it  
2 onto 46 and we get 60.

3 MR. GIBBS: If you're  
4 going to re-direct get the number.

5 MR. SCOTT: All right, let's  
6 take 14 and add it on and we get 60, and then I think  
7 that what we have is that Foothills is doing 60 miles  
8 over 2 1/2 to three months.

9 MR. GIBBS: The witness said  
10 three months.

11 MR. SCOTT: All right, three  
12 months.

13 MR. GIBBS: Mr. Commissioner,  
14 if Commission counsel is going to ask the questions  
15 he surely ought to put them accurately. The witness  
16 said three months and the witness said 14 miles.

17 MR. SCOTT: All right, I regard  
18 this as important to set the balance right in this  
19 particular matter.

20 Q Now, Mr. Williams, if  
21 you add 14 miles to the 46, you get 60. Right?

22 A Yes.

23 Q All right, and I take  
24 it your understanding of the Foothills case, perhaps  
25 like mine is that they were going to build 60 miles over  
26 three months.

27 A Yes.

28 Q And you hope to build  
29 67 miles over 5 1/2 months.

30 A 74, I think.



G.L. Williams  
Cross-Exam by Scott

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Q All right, 74.

MR. GIBBS: Let's get the numbers straight.

MR. SCOTT: All right. I think it's important to restore the proportions in view of the examination that's just taken place.

Q Well now, let me ask you one other thing. Have you ever observed the manner in which drilling is conducted in the Arctic Islands? Or heard about it?

A I haven't observed it. I've heard it, I've heard of it.

Q You're aware that there would be about two months a year of almost complete darkness on those islands.

A Yes.

Q And are you aware that that drilling is conducted almost exclusively in those periods of time under floodlights?

A Yes sir.

MR. SCOTT: I think those are all the questions I have, thank you, Mr. Commissioner.

MR. GIBBS: One of the finest re-directs I've heard for quite a while.

MR. BAYLY: Mr. Commissioner, I have no questions of Mr. Williams, but I have been informed by Mr. Marshall that Mr. Williams and Mr. Lawrence have had a discussion on the campsite at Komakuk Beach and I want to address my questions to



G.L. Williams

1 Mr. Lawrence tomorrow on that subject.

2 THE COMMISSIONER: All right.

3 MR. MARSHALL: I have no  
4 re-direct on the cross-examination of the rebuttal  
5 evidence, sir.

6 THE COMMISSIONER: Well,  
7 Commission counsel has the right of acting for Foot-  
8 hills one day, Arctic Gas the next day, and the COPE  
9 the day after that. That's his role. I think that  
10 the questions Mr. Gibbs put apply generally to the  
11 Arctic Gas project and the Foothills project, if you  
12 throw in the extra 14 miles along the lateral from  
13 Parsons Lake. Sorry, did you want to say something?

14 MR. SCOTT: The only point  
15 is  
16 I've made obviously/there is no limit to the kind of  
17 examination any of us can conduct, subject to your  
18 ruling. I must say, in view of the evidence -- and  
19 perhaps Mr. Gibbs was not here when it was called --  
20 but in view of the evidence that the Parsons Lake  
21 lateral was being built at the same time, it seemed  
22 to me that much of the cross-examination simply failed  
23 to deal with the real facts. Now I didn't interrupt  
24 at the time.  
25  
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G.L. Williams

1 MR. GIBBS: The only  
2 point which if we're going to get into the real facts,  
3 then I think one should go back into the transcript  
4 and see what the Foothills panel said and what my  
5 friend says they said and what the witness says they  
6 said is not borne out by the evidence which was pres-  
7 ented.

8 I have here the exhibits  
9 which shows fall starting on any of the Foothills  
10 plans, none of them later than mid-December being able  
11 to start haulage and so if we're going to get into  
12 exactly these precise definitions then I think the  
13 Commission Counsel is obliged to turn up the transcript  
14 reference and not say what he recollects or the  
15 witness.

16 MR. SCOTT: Mr. Commissioner,  
17 if I was mistaken and the Parsons Lake lateral is not  
18 going to be built in that spread and those extra miles  
19 which were not referred to are not going to be built,  
20 I owe Mr. Gibbs an apology. If that is what the  
21 transcript says.

22 MR. GIBBS: I was not talking  
23 about the Parsons Lake lateral. I was talking about  
24 the commencement date which snow roads can be completed  
25 and so on.

26 *Burger* *p. 13056*  
27 THE COMMISSIONER: Well, I  
28 think I'll call a halt to this particular argument. My  
29 only comment is this, that notwithstanding the  
30 strictures of Dr. Cranfield about the adversary  
proceedings that we have had before this Inquiry.



G.L. Williams

1  
2 I think that the  
3 virtues of having two pipeline companies in the ring  
4 testing each others proposals are self-evident, but  
5 as far as I'm concerned it is the feasibility of  
6 doing this work in the winter, in the dark, in the cold,  
7 whether it can be done under artificial lighting and  
8 whether it can be done by either pipeline company in  
9 the way and in the time that they say it can. That's  
10 what concerns me.

11 Running through this  
12 Inquiry there is certainly on the part of many, there  
13 is an unstated function and Mr. Williams made it  
14 explicit tonight. He said, well, technology is capable  
15 of many things. It has placed a man on the moon, so  
16 it will devise a way of building a pipeline in the  
17 Arctic, in the middle of winter, in the cold and the dark  
18 and under artificial lighting if necessary.

19 Maybe technology will,  
20 maybe it can, maybe it won't, maybe it can't, we're  
21 seeking here to predict whether it can be done. And  
22 I may say though like everyone who lives in our country  
23 I am aware of the triumphs of technology. I'm aware  
24 of its limitations as well and you can go back to the  
25 day in 1969 when a man landed on the moon. That was  
26 a venture in which the treasure and technology of the  
27 richest nation on earth was devoted for a period of  
28 something like ten years to the attainment of that  
29 object which would seem to be essential to the  
30 prestige of United States.



G.L. Williams

1  
2 Cost was no object. Here  
3 we're dealing with a project that private investors  
4 are going to be called upon to pay for, so far as we  
5 know. It hasn't yet been said that the public is  
6 going to have to pay for this.

7 The investors are going  
8 to have to pay for it. It's got to be an economic  
9 proposition. The consumers, industrial and residential  
10 of gas in Canada and the United States will be the  
11 ones who will have to pay and we should be able to--  
12 We have to determine as best we can whether it can be  
13 built in three years. Whether it will take four or  
14 five.

15 At any rate, I want  
16 to remind those present that the oil and gas industry  
17 told us five years ago that Canada had enough gas to  
18 last Canadians for three hundred years. That was  
19 based on the predictions of engineers and geologists  
20 and we're now told that we're facing a shortage this  
21 winter. That is a failure, it seems to me, of  
22 technology and it's that kind of failure that can  
23 occur and should be borne in mind, side by side and  
24 along with the triumphs of technology.

25 Well, we'll recommence  
26 at 9 a.m.

27 (WITNESS ASIDE)

28 (PROCEEDINGS ADJOURNED TO NOVEMBER 14, 1975)  
29  
30

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Vol. 86 13 November 1975

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M835  
Vol. 86





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MACKENZIE VALLEY PIPELINE INQUIRY

Government  
Publications

IN THE MATTER OF APPLICATIONS BY EACH OF  
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A  
RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS  
CROWN LANDS WITHIN THE YUKON TERRITORY AND  
THE NORTHWEST TERRITORIES, and  
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY  
THAT MIGHT BE GRANTED ACROSS CROWN LANDS  
WITHIN THE NORTHWEST TERRITORIES,  
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND  
ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION,  
OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE  
PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

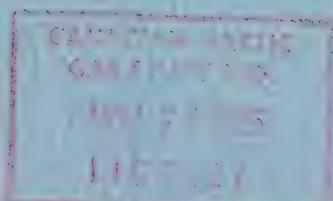
November 14, 1975.

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PROCEEDINGS AT INQUIRY

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Volume 87





APPEARANCES:

Mr. Ian G. Scott, Q.C.,  
Mr. Stephen T. Goudge,  
Mr. Alick Ryder and  
Mr. Ian Roland for Mackenzie Valley Pipeline  
Limited;

Mr. Pierre Genest, Q.C.,  
Mr. Jack Marshall, and  
Mr. Darryl Carter for Canadian Arctic Gas  
Pipeline Limited;

Mr. Reginald Gibbs, Q.C.,  
Mr. Alan Hollingworth &  
Mr. John W. Lutes, for Foothills Pipe Lines Ltd.;

Mr. Russell Anthony &  
Pro. Alastair Lucas for Canadian Arctic Resources  
Committee;

Mr. Glen W. Bell and  
Mr. Geery Sutton, for Northwest Territories  
Indian Brotherhood, and  
Metis Association of the  
Northwest Territories;

Mr. John Bayly  
or  
Miss Leslie Lane for Inuit Tapirisat of Canada,  
and The Committee for  
Original Peoples Entitle-  
ment;

Mr. Ron Veale and  
Mr. Allen Lueck for The Council for the Yukon  
Indians;

Mr. Carson H. Templeton, for Environment Protection  
Board;

Mr. David Reesor for Northwest Territories  
Association of Municipal-  
ities;

Mr. Murray Sigler for Northwest Territories  
Chamber of Commerce.

CANADIAN ARCTIC  
GAS STUDY LTD.

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Davison, Vaartnou, Lawrence  
Taylor Reeves  
Cross-Exam by Bayly  
Yellowknife, N.W.T.

November 14, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

L.W. BOUCKHOUT,  
C.W. DREW,  
Frederic B. CLARIDGE,  
D.M. DAVISON  
Herman VAARTNOU  
Norman A. LAWRENCE,  
James R. TAYLOR,  
Brian O.K. REEVES, resumed:

CROSS-EXAMINATION BY MR. BAYLY (CONTINUED);

Q Mr. Drew, before we leave  
the subject of gravel resources, I think I got side-  
tracked to the south end of the route and the Yellowknife  
service line and didn't get an answer to my question  
with regard to gravel shortages near the hookup with  
the producers' facilities. Now, we have heard from  
Arctic Gas that they anticipate that in the Parsons  
Lake area there may be some real shortages of granular  
material. The producers, we are told, by them, through  
one of their witnesses, Mr. Hemstock, anticipate the  
requirement of three million cubic yards. That's an  
area that Dr. Mollard has said there may be some  
real shortages experienced. Is that the information  
that you have given to Foothills as well?

WITNESS DREW: Well, I haven't  
given any information to Foothills at all on the gravel.  
All I've done so far is terrain typing. I haven't  
actually analyzed and made any estimates of volumes of  
gravel or anything else yet, and just for my initial  
reconnaissance I couldn't do all the field checking I  
wanted in the Parsons Lake area when I was up there in



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 September because weather didn't permit even helicopter  
3 flying, so I've still got to look at some more of that.  
4 But, where I did go in that area, I did see some fairly  
5 good supplies of gravel and sand. There's quite a bit  
6 of outwash material, I have no idea of the quantity  
7 yet, and in a minute I'll let Mr. Davison add something  
8 to that.

9 I just want to correct one  
10 thing I said yesterday just before lunch, I didn't  
11 get a chance. We have the maps up here now and they refresh  
12 my memory and the pipeline is closer to the Great  
13 Slave Highway, I guess you'd call it, than I had  
14 estimated yesterday just from memory.

15 Q Yes.

16 A It appears to be one to  
17 two miles, it looks like, between Rae-Edzo and Yellow-  
18 knife, and at Birch Lake the farthest point is about  
19 15 miles from the highway, and the same near Hay River.

20 Q Yes, there appears to  
21 be one section where it departs from the highway fairly  
22 significantly between Providence and Rae-Edzo for a  
23 distance of perhaps 60 or 70 miles.

24 A . That's where it's a great  
25 distance from the highway, but it's far enough in  
26 other places that when you're traversing and landing  
27 on a pipeline route you don't see the highway generally.

28 Q Yes.

29 A I'll let Mr. Davison  
30 say more about gravel around Parsons Lake.



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Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

WITNESS DAVISON: Yes, we

carried out a granular inventory for DIAND several years back, which covered the Parsons Lake-Eskimo Lake area, and identified the potential sources of material in that area, indicating approximate quantities of material that we felt would be conservative estimates. Subsequently we carried out an investigation for one of the users in that area, and went into one of the sources that we found in that initial study for DIAND, and we were able to supply or gain the requirements, much more material from that one source than had been originally anticipated. They wanted a large volume and we only drilled a portion of that source and found much more gravel.

Q All right, you are aware, I take it, of the other requirements, and I don't mean for independent facilities, but for facilities of the producers which must necessarily be built if you are to put any gas into your facility in the Parsons Lake area.

A As to their quantities, no, I'm not aware of all the quantities that they're proposing to use. I feel that there is -- that is one area where I feel there is a lot of gravel or granular materials.

Q One of the concerns that was expressed to the Arctic Gas panel was with regard to one of their preferred borrow sites near the settlement of Fort Good Hope, and I'm wondering whether some



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
CrossExam by Bayly

1  
2 of the sources that had been identified either by the  
3 government's granular material survey or by Foothills  
4 Pipe Lines are ones that are close enough to communities  
5 that there may be some competition between the  
6 community and the pipeline company for these sources,  
7 either because the company wants to use them, or because  
8 the company wants to preserve the site for some other  
9 use.

10 A Well, on our study for  
11 DIAND, it was a twofold study, first to determine  
12 enough materials for the communities. In other words  
13 there was studies for Inuvik, Tuktoyaktuk, Arctic Red  
14 River, Fort McPherson, the requirements for these  
15 communities were part of our terms of reference. Then  
16 it was the second stage was to determine other borrow  
17 sources that might be available outside and in addition  
18 to those quantities of material.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
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Cross-Exam by Bayly

Q Right. The second part  
to my question, Mr. Davison, and it is this, that there  
may be sites and the one at Fort Good Hope was  
brought up as an example by Mr. Bell where the  
community might well want to preserve what is an  
excellent gravel source as a favorite picnicing spot  
fairly close to the community. Now, for them it has  
quite a different kind of value from the kind of value  
that somebody wanting to build a facility would put  
it to. In fact, the community might not even want to  
use that for their own gravel or for their own roads  
and airstrip, etc.

A I'm sorry. I couldn't  
answer. That sounds like a socio-economic problem.

Q All right, but it is a  
granular material problem, too, isn't it, because these  
things must be -- you must look at the whole picture?  
If there are these conflicts you must determine  
whether there are alternate gravel minings sites that  
could be used by your applicant?

A Yes, in defining the  
various gravel sources, we indicated what the potential  
problems might be for development, whether they be  
environmental problems or physical -- actual physical  
problems -- of the development of the site.

Q Yes, I think Mr.  
Bouckhout wants to say something.

WITNESS BOUCKHOUT: A Yes,  
I might add to that. We do intend to do an update on



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 our identification of borrow sources. We will be  
3 doing some more work in that particular area. As I  
4 have mentioned, we have already had a biologist in that  
5 field looking at some of the sources.

6 The sources have been  
7 indicated to date as I said yesterday were those  
8 sources which had been indicated by either the DIAND  
9 inventory or Federal DPW.

10 Now, in reference to  
11 Good Hope per se, I think you are aware that we are  
12 considering a pretty major realignment around the  
13 community of Fort Good Hope to get out of the develop-  
14 ment control zones and so on.

15 So that would take us  
16 considerably farther away from the existing excellent  
17 gravel source on the esker at Good Hope. And could  
18 possibly put us in an area where there is more gravel  
19 sources available quite a bit farther away.

20 Q These are things that  
21 you have to study yet from the purpose --

22 A That's right. These are  
23 things that will be coming up in the future phases.  
24 As I say, we have identified to date the potential  
25 quantities, etc. from pits that have been designated  
26 by other operations and we will be up-dating our  
27 information and inputting much more of this information  
28 into our final selection of the gravel sources, including  
29 the need for the various communities along the line.  
30



Pouckhout, Drew, Claridge,  
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Taylor, Reeves  
Cross-Exam by Bayly

As I said yesterday as well, we do not intend to compete with the community as we appreciate the need for gravel sources of the communities and the fact that they have probably less ability to get gravel from great distances than we might have.

Q Yes.

WITNESS DREW: A I can be a little more specific about Fort Good Hope. I just revised a re-terrained type. The alternate route by-passing Fort Good Hope further up crossing the Hare Indian River further upstream and there are a lot of glacial fluvial deposits which should be a good sources farther from Good Hope than that big esker which I don't think it was ever planned to tap anyway because we realized the importance, I think, picnic area and I think there is also some religious or some other importance of that esker to the community.

Q All right.

A But there are plenty of other sources closer to where our pipeline is going to be now.

Q Yes, and when you say the glacial fluvial sources, are these ones that are also inactive river areas?

A Well no, glacial fluvial is a material formed by outwash from the glaciers. In other words, at the time that the glaciers were melting



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1 Or even while they existed, water flowing beneath the  
2 ice beside the ice or out in front of the ice deposited  
3 lots of coarse material. Those are the glacial fluvials.  
4

5 Q I realize that can  
6 happen independently of present water courses but it  
7 can also coincidentally occur near water courses.

8 For example, some  
9 of them may be near the Hare Indian River and perhaps  
10 you could tell me whether they have been identified  
11 in that area.

12 A Well, that's right. The  
13 sources I was thinking of are not the high terraces  
14 along the river but there are Kame type deposits,  
15 outwash, well plains, terraces, so forth and various  
16 types of deposits that are considerable distance from  
17 the river and probably even other eskers.

18 Q All right. Let's presume  
19 Mr. Drew, for a minute, that I am correct in my  
20 statement that near Parsons Lake and somewhat south  
21 of that, that there will be difficulty both to the  
22 producers and the applicant to find as much of the kind  
23 of granular material that they want for their various  
24 facilities. Have you or have you had discussions with  
25 the engineers to determine what the minimum requirements  
26 are?

27 A No, I haven't had any  
28 discussions at this stage I'm at yet. Right now, I  
29 haven't myself been involved in a gravel inventory. I  
30 have been involved in taking all the corridors assigned



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Bayly

1  
2 and saying what surficial geological units or terrain  
3 types lie in the corridors and what their general  
4 estimated terrain sensitivity is from an environmental  
5 point of view. That's the stage to which I have  
6 carried my work up to this time. I'm sure that when  
7 you go further into it and you are getting towards  
8 design stage and so forth that somebody would have to  
9 of course, make a gravel inventory, or a granular  
10 inventory.

11 Q Okay, Mr. Bouckhout, one  
12 of the great selling points of the method that you  
13 have said Foothills has been using is that you are a  
14 small enough group that you can get together and discuss  
15 these things almost in a spontaneous fashion, and what  
16 I am suggesting to you is that ~~there~~ may have been or  
17 ~~there~~ / may be planned discussions to decide what the  
18 minimum requirements are, so that your engineers can  
19 say, listen for a compressor station, we've got to have  
20 number 1 grade certain size coarse material for the  
21 pad on which the compressor station goes. We cannot  
22 do with sand or sandy silt so you have got to find us  
23 that however far you have to go, or they may say, "Listen  
24 for another part of the facility near a river bank you  
25 don't have to give us as good gravel from an alluvial  
26 outwash or a glacial moraine. We'd be quite happy if  
27 you went out and blasted a bit of bedrock and crushed  
28 it up and we'd use that for riprap."

29 Now, these are things I  
30 am assuming will be done and have to be done between



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves,  
Cross-Exam by Bayly

1  
2 the people on this panel and the people who will tell  
3 you what the requirements and the minimums are that  
4 are required from an engineering standpoint are.  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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A These are things that obviously have to be done and will be done. Our geotechnical people will be working in future on the borrow sources. As I said, we have tentative general information as to how much we need. As far as quality is concerned as to what is required for this type of operating, I believe I gave you some kind of an indication yesterday regarding what general percentage of the material we would be taking of the pits that have been identified <sup>to date,</sup> /that we have identified to date as potential sources would be and there I believe I gave you figures something in the order of 7 to 17% of just general fill and something like 0.6 or 0.8 to about 2 or 3% of aggregate, concrete aggregate.

Now the aggregate, of course, is of high quality material, is necessary for making river weights and swamp weights and so on, on the general fill which we'll be using to a great extent is material used for pads and so on.

Q Well you will agree with me though that there may be a problem getting in certain areas what you require. One of the difficulties in generalizing if you take Mr. Davison's granular survey that the government did, they will tell you that there are millions and millions more cubic yards than you could possibly need. But they may be a long way away and economically they may be difficult for you to get in certain areas. There are going to be areas as Dr.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

1  
2  
3 Mollard has said, where there are pits with some  
4 granular material in them but no self-respecting  
5 contractor would go into them.

6 A If you identify, Mr. Bayly,  
7 that a problem is a situation whereby it costs a little  
8 bit more, you have to go a little bit farther for the  
9 gravel than a closer source, certainly there may be  
10 a problem.

11 However, we would be  
12 prepared to do that.

13 Q Well, this is where the  
14 problem really reaches a crunch, I would suggest to  
15 you Mr. Bouckhout and that is where you have a source  
16 that is convenient but somebody else might require it  
17 in the future for the expansion of Inuvik, for the road,  
18 that somebody might want to build from Inuvik to  
19 Tuktoyaktuk, or some use like that and you might say,  
20 being the first person there, and without knowing any  
21 specific plans that anybody else had, we require that  
22 material, it's there and we are going to take it.

23 And you will get your permit  
24 because you will establish a bonifide need for this  
25 and what it will mean is that the subsequent users,  
26 whose development may even be as a result of yours,  
27 may not be able to do certain things that they would  
28 otherwise do because you have taken material better  
29 than you require, because it was closer and more  
30 economical to do so and at the time appeared to be  
sensible.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

1  
2  
3 A Well, Mr. Bayly, for one  
4 reason or another we have been unable to identify  
5 potential future users of that particular material,  
6 I would hope that the government agencies who are  
7 responsible for granting the permits will have been  
8 able to determine these potential alternate users and  
9 use that in their assessment of our sources as well.

10 Q Well, that is the sort of  
11 thing that worries me, Mr. Bouckhout, that sometimes  
12 that doesn't happen and for that reason I am hoping that  
13 we will get the same sort of response from you that we  
14 did from Arctic Gas. But the kind of material you  
15 will use, will be the kind of material that you require  
16 rather than always the best available and closest. So,  
17 you will take into account for example, that certain  
18 needs that haven't even been defined are not completely  
19 precluded by your project.

20 A To my mind I would certainly  
21 be taking this into account, unquestionably.

22 WITNESS DAVISON: Mr. Bayly,  
23 if I might, I would like to correct one statement you  
24 made.

25 MR. BAYLY: I am glad it's only  
26 one Mr. Davison.

27 WITNESS DAVISON: You were  
28 suggesting that the DIAND inventory, particularly the  
29 northern part, would be estimating millions of yards,  
30 that is over-estimating, and our approach to the problem



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Bayly

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2  
3 was that based upon the information and the data we  
4 gathered we did not want to be over-confident, we  
5 under-estimated it if anything and what I indicated, that  
6 particular source that we went into for this private  
7 producer, we found much more material in that source.

8 MR. BAYLY: I am not  
9 suggesting that the granular survey even grossly  
10 over-estimated anything or even over-estimated anything  
11 at all, but they did a granular survey, and you can  
12 correct me again if I am wrong, for the entire valley  
13 and they gave a figure for the entire valley and I am  
14 suggesting to you that that figure is meaningful only  
15 in that general sense. And when you pick a route, the  
16 general figure only has application if you had un-  
17 limited resources and were prepared to go anywhere in  
18 the valley to get what you needed. But your not  
19 prepared to do that I submit. Your not going to go to  
20 the Mackenzie Mountains to get gravel for the Fort  
21 Simpson area. Not that you would have to, but that kind  
22 of example. Your not going to go 150 miles to get  
23 gravel.

24 A I believe this has all  
25 ready been taken into account in using the granular  
26 inventory and public works information as to the  
27 available sources along the line and how that material  
28 would be used from the sources.

29 Q Yes, in some cases, rather  
30 than go 150 miles, you will take a grade of material







Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Bayly

1

2

WITNESS BOUCKHOUT: Most

3

definitely.

4

Q There's nothing strange

5

about this project?

6

A No, not at all.

7

Q Then we'll move on to

8

archaeological considerations. I believe that's

9

Dr. Reeves?

10

WITNESS REEVES: Yes sir.

11

Q Dr. Reeves, one of the

12

concerns that arises out of your evidence is that you

13

have said that when material is removed which has

14

archaeological significance it will be -- and I'm

15

referring to page 49 -- it will be analyzed and inter-

16

preted and reports written and published, and that the

17

artifacts and documents will then be deposited in an

18

appropriate museum. Quite frankly, one of the concerns

19

of the people of the north is that many of the approp-

20

riate museums with northern artifacts are located in

21

Germany, Ottawa, Toronto and places like that where

22

the people of the north --

23

THE COMMISSIONER: Have you

24

got that? Germany, Ottawa, Toronto.

25

A You forgot New York and

26

Washington.

27

MR. BAYLY: Yes, there are

28

a lot of museums other than the one that's being built

29

across the road here, or possible museum in Aklavik

30

that received these artifacts that do come from the



Bouckhout, Drew, Claridge  
 Davison, Vaartnou, Lawrence  
 Taylor, Reeves  
 Cross-Exam by Bayly

1 north, and have you made any suggestions to your  
 2 applicant as to what should happen to artifacts that  
 3 come from the north when they're discovered as a result  
 4 of their project?

5 A Nothing formally, but  
 6 they would be deposited in northern museums.

7 Q All right, and what do  
 8 you mean by "northern museums"?

9 A Museum here, museum at  
 10 Aklavik.

11 Q You would envisage them  
 12 then staying in the north?

13 A Yes, most definitely.

14 Q Now, the other statement  
 15 that you made that I think deserves some clarification  
 16 is that you've determined that some sites are important  
 17 and other sites are not important, partly on the basis  
 18 of what you're able to find at a site and I think  
 19 your example was a single example of a paleolithic tool  
 20 found in an area may not be of significance. Now I  
 21 take it that that comment just isn't complete because  
 22 very often a single paleolithic tool is the key to  
 23 either a mystery that hasn't been solved archaeologically,  
 24 or the key to the location of an important site. In  
 25 other words, it deserves more work if you find one.

26 A The single tool I refer to  
 27 is the site, that is what we call an isolated find,  
 28 it was something that was left broken, say a broken  
 29 spear point, broken during hunting and discarded by  
 30 the hunter. That is what I mean when I refer to a



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1 site of no further value.

2 Q All right, well how do  
3 you determine that, that it wasn't say a campsite where  
4 a man broke his tool when he was fixing it?

5 A Oh, well if there was a  
6 campsite there would be more evidence.

7 Q All right, how do you  
8 determine that evidence being perhaps not a very great  
9 distance ahead of the wheel ditcher or the blaster?

10 A By excavation.

11 Q Now what sort of excava-  
12 tion are you referring to?

13 A There are a variety of  
14 archaeological techniques that can be used.

15 Q We're talking about  
16 winter construction.

17 A In the construction phase?

18 Q Yes.

19 A Mainly in front of the  
20 ditcher?

21 Most sites, as I said  
22 in my evidence, will be found in advance of the  
23 construction process either during -- before and during  
24 the clearing of line. That is most sites of value.  
25 Those which will be found perhaps immediately in  
26 advance, while the pad is being prepared, or even  
27 later, will be either particularly old or localized  
28 occurrences. When I refer to a localized occurrence,  
29 I am referring to something which may be the single  
30 stone tool or some other thing perhaps of a very local  
nature. What will be done in terms of something of



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1 outstanding value is found, I presume this would be  
2 -- would have to be worked out between the government  
3 agencies responsible for monitoring the archaeological  
4 program and other interest groups, and the contractor,  
5 and the pipeline company.  
6

7 Q Now, let me understand  
8 then what you mean by "prior to construction". First  
9 of all there will be clearing of the right-of-way and  
10 during clearing somebody may find something on the  
11 surface. That's one way of locating a possible site,  
12 is that correct?

13 A That is correct.

14 Q Perhaps at a river gravel  
15 bar, or something like that?

16 A All the particularly  
17 sensitive areas will be investigated before the line  
18 is finalized, for example the east arm of the Mackenzie  
19 at Swimming Point crossing, major river crossings,  
20 particularly sensitive areas adjacent to lakes, Chick  
21 Lake, for example.

22 Q So you will go in with a  
23 program of investigating sensitive sites on --

24 A Sensitive areas.

25 Q Sensitive areas. Well,  
26 what do you mean by an area?

27 A Areas which potentially  
28 could contain prehistoric sites. From the information  
29 we have on known sites, as I said in my evidence, there  
30 is none known to be on the line. However, this information



1 is not always precise.

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1

2

A In certain cases.

3

Q Yes.

4

A But as I say, when I

5

say "sensitive areas" I mean areas which are preferred

6

by past peoples for use as campsites, as hunting areas,

7

where you will expect sites to be located of value.

8

For past native peoples or anybody today to subsist.

9

You require shelter, you require wood, you require

10

water, dry ground, certain size of area, there are

11

certain perimeters that man has to live by.

12

Q All right, but that

13

takes you into, archaeologically, the recent past. If

14

you consider the possibility of finding sites where

15

water courses used to go, or where trees used to

16

supply sources of fuel, or where conditions were

17

better for game than they are now. There may be sites

18

that in this particular epoch don't make any sense,

19

but perhaps when we're looking at archaeological time

20

frames may have ~~made~~ sense and that's where you expect

21

-- you don't expect the surprises, but that's where

22

you might find surprises.

23

A That's quite correct.

24

Q And the method of finding

25

those surprises is quite different from your area

26

exploration. When you say, "I'm going to look at

27

Chick Lake and I'm going to look at some other areas

28

that I think may well be good archaeological sites,"

29

that's on the basis of what you can see on the ground

30

today that would make them good, say, campsites,



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1 hunting sites, fishing sites, etc. Is that not correct?

2 A Yes.

3 Q So, the older sites, if  
4 I may call them that, will be the surprises and the  
5 method of finding those may well be to clear and if  
6 you don't find anything on the ground you've got a  
7 drilling program and if something comes out of a drill  
8 core that looks interesting to you, then you may have  
9 found a site. Is that correct?

10 A That may be the case.

11 Q All right, that's sort  
12 of like little Jack Horner putting his thumb into the  
13 pie and pulling something out of that, is that not  
14 correct? You're not drilling every foot of the line,  
15 so you run into that possibility of missing a site.

16 A Yes.

17 Q All right, and the next  
18 step after the drilling and say little Jack Horner  
19 is not successful, and nothing comes out on his  
20 thumb, then in comes the equipment such as the  
21 wheeled ditcher, the blaster, etc., and you or some-  
22 body like you will be trying to look at some of that  
23 material to see whether the line has actually gone  
24 through a possible site. Is that correct?

25 A Yes.

26 Q And this kind of excava-  
27 tion is the archaeologist's great dilemma. One it  
28 opens up sites on a chance basis that may be very  
29 valuable, but two, it stands a good chance of destroyin  
30



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those sites, or partially destroying them.

A I think that needs a little qualification. You're correct. It opens the sites up that would not be found otherwise. It may destroy part of the site. The amount of a site is of value and certainly you're quite correct in terms of whole sites, it will depend on the size of the site.

Q All right, so to put this into perspective, if the line is to be built, it's a very good thing to have the archaeologists there to have a look at what is being excavated in one way or another, but if you were to do a site specific excavation you'd prefer to use the kind of tools we see in National Geographics in the hands of the late Dr. Leekey rather than a wheeled ditcher.

A Well, very few of us in North America use Dr. Leekey's tools. He's been working in solid rock.

Q Yes, but you appreciate the problem, though.

A The thing also, as I pointed out in my evidence, these sites found during construction phases, which is impossible to do anything about, will be excavated after.

Q All right.

A So the program is as complete as we can possibly do it.

THE COMMISSIONER: Excuse me, let's just go back a bit. Foothills plans to clear the



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1 right-of-way, the whole right-of-way before any  
2 construction is carried out, so presumably in clearing  
3 the right-of-way it may be that an archaeological  
4 site of importance would be unearthed or discovered.  
5 Now, the next thing that happens is <sup>that</sup> the ditcher comes  
6 along. Now, between the time of the clearing and the  
7 time the ditcher comes along, are there any plans to  
8 do any -- conduct any search for archaeological sites?  
9 Mr. Bayly mentioned drilling. Is that planned, or  
10 are we simply looking at clearing and then the ditcher?  
11

12 A Well, once the line is  
13 clear, that is in those areas which we can't effectively  
14 do anything, it will be completely reconnoitered for  
15 archaeological  
16 / sites, We'll look at the sites, evaluate them and  
17 excavate them, those of value, which can be done before  
18 the ditcher comes. In general, in most areas, there  
19 will be sufficient time.

20 Q Now, when the ditcher  
21 comes along and unearths new sites, then the construc-  
22 tion will simply go ahead <sup>and</sup> after the ditcher has dug  
23 out the ditch and after the pipe has been laid, and the  
24 backfill has been placed in the trench, then and only  
25 then I take it, can any kind of salvage operation be  
26 undertaken. You're not going to be standing beside  
27 the ditcher and when something is unearthed stop  
28 construction so that you can carry out a salvage  
29 operation.  
30



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A No. In certain areas which are geologically, say, suitable for very old sites being present. There will be an archaeologist available to monitor these sections of the ditch and record information from the walls, but by the process of ditching the artifacts themselves are taken out of context and lose their values, most of their value.

Q So your man is -- he comes after the ditcher and before the pipe, takes inventory of what he sees on the walls of the ditch--

A And on the spoil pile.

Q Right. And then he is out, the pipe is down and if it is worth looking at in a greater scope then you can come back there and dig away some more, provided that you don't interfere with the pipe?

A That's correct.

MR.BAYLY: Q Now, one of the problems, I gather, is that unless the archaeologist is almost in the spew of the wheel ditcher, he may miss what is arriving onto the spoil now and we shouldn't expect the average construction worker to say, "That tooth is very important. That's a paleolithic animal," when /that particular man, even if he sees the tooth, will probably think it is some dog, or fox, or wolf that died there. Is that not a kind of problem that you would expect?

A Yes.

Q And the other kind of



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1 problem is that if you want to do any further work at  
2 the site and at the time, quite apart from the fact  
3 that the construction project is costing a lot of money  
4 per day per mile, you also run into the problem that  
5 it's very difficult to do the fine kind of excavation  
6 that archaeologists like to do at 30, 40, 50 below,  
7 whatever the temperature may be but in hard, frozen soil.  
8 Is that not correct?  
9

10 A That's correct. Also  
11 working in permafrost in the summer.

12 Q Yes, I realize you run  
13 into that same problem in the north early in the summer.  
14 You do have the added factor of the cold air and trying  
15 to do things delicately with mits on and it is going  
16 to be a job.

17 A It certainly will.

18 Q Really, to start with, it's  
19 a question of luck whether you find anything and then  
20 there may be -- now, I'm not talking about the areas  
21 that you've defined as ones where you think you're likely  
22 to discover something, but luck is involved in finding  
23 those unexpected treasures that archaeologists dream  
24 of, the old sites in areas that they don't expect and  
25 the other thing is that it is going to be luck that  
26 that can be identified.

27 Now, is your archaeologist,  
28 for example going to walk through the ditch the entire  
29 1,200 miles, or whatever it is, looking at the walls to  
30 see whether there really is something? I don't mean



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under the rivers but apart from that.

A Perhaps under the rivers would be a better place. No, let me explain it this way by using an example. We're dealing with all kinds of terrain. Now, even very old sites, if we're dealing in say glacial till, which is a surface material and subsurface material. A very old site. Say perhaps something 10,000 years -- It's going to be right on the surface because there's been practically no very little accumulation in the last 10,000 years on certain areas. Whereas perhaps where we're going through a glacial lake basin or a series of terraces, lake terraces say around Chick Lake, if I may use that, where we're dealing with a change in lake level through time in an area which is suitable for occupation and we know that people used fish lakes for around 10,000 years in the Mackenzie basin.

Here would be a place where you could have materials preserved to some depth in these beaches like we do on Present Beach. This would be an area where an archaeologist would want to monitor the ditch very closely.

Q And you won't see --

A It is localized to some extent.

Q Right. But you won't be able to train your construction workers really to do this. This is something that takes a trained eye and if you're expecting to find a nice bleached skull or



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1 a shiny paleolithic arrowhead, you're not going to  
2 find it in that condition. It's going to be a dirty  
3 old piece of bone or stone that only an archaeologist  
4 could love, at that stage. It's not going to be  
5 something that is easily identifiable as such by the  
6 untrained eye.  
7

8 A That's correct. I should  
9 have added a little more. The statigraphy that is,  
10 the deposits that are exposed, the cultural bearing,  
11 the potential culture bearing deposits, the geological  
12 deposits which are exposed in the ditch are equally, if  
13 not more, important than what comes up in the spoil  
14 pile because if it is a site, there will be evidence  
15 of it in the ditch if it's not a very localized occur-  
16 rence. In the case of bones, the chance of nice skulls,  
17 dirty or otherwise, being preserved in many locals  
18 is practically nil.

19 O Yes. Now, one of the  
20 other areas, I understand/ <sup>where</sup> archaeologists could be  
21 very helpful is in the area of things like burial  
22 ground that don't have any markers that may be known  
23 or even forgotten by the native peoples but which the  
24 applicant could unwittingly go across and find that  
25 they had destroyed something which might not be of  
26 archaeological value but might be of a great deal of  
27 value to the people and I think in the book, "Arctic  
28 Imperatives", Mr. Ookpik who is here today mentioned  
29 what are called secret burial grounds of the ancestors  
30 of some of the people in the Delta area that they hold



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to be very important and I don't expect the applicant  
would want to go through those if they could possibly  
be avoided.

A Certainly not.

Q And have you done or will  
you be doing investigations to find out where these  
either are or likely to be so that they can be avoided.

A Yes, we will.

Q Has that work begun?

A No.

Q When will it begin?

A Once there is more design  
on the line.

Q Now -

THE COMMISSIONER: Tell me, is  
that something that would not be done until Foothills  
got the go ahead from the government to build this  
pipeline?



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3 WITNESS BOUCKHOUT: That I  
4 don't think, Mr. Commissioner, is necessarily correct.  
5 One of the aspects we have to consider when we are  
6 talking about the archaeological program is what really  
7 can a program do until we have got a line open.

8 Now, certainly as Dr. Reeves  
9 has mentioned, we can go in and reconnoiter some of the  
10 areas which Dr. Reeves considered as sensitive areas.  
11 The areas where we are likely to find things. But  
12 until, as I understand it, until we actually have a  
13 clearing or an opening, say for instance, in a work  
14 site or a stockpile site location, a compressor station  
15 location, the mainline, access roads and so on, You  
16 are really wandering around fairly blindly in a mass of  
17 trees and you need something to have a look at the  
18 ground. So, really there are several stages before we  
19 clear any lines. Dr. Reeves can go in, given our  
20 route locations, our facilities locations and reconnoiter  
21 those areas he feels are sensitive and there is good  
22 potential to find something.

23 Beyond that, we would go in,  
24 once we have done that clearing, we have the next summer,  
25 therefore he could go in with that cleared line and  
26 certainly he doesn't have to do the entire 820 mile  
27 mainline in one summer since you know the construction  
28 proceeds<sup>in</sup> over two years, so he does have two summers in  
29 that area to reconnoiter the line.

30 Beyond that there is a facility



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3 that if in this reconnoitering Dr. Reeves found a very  
4 major find which could contribute significantly to the  
5 archaeology of the north, we certainly have the option  
6 then to bend the pipe around that particular location.  
7 In other words, we could cut a new line in that  
8 particular location, if it is justified on the basis  
9 of a very, very significant find which could not be  
10 excavated in a given time prior to ditching.

11 Q Mr. Bouckhout, what is  
12 a very, very significant find and who makes that  
13 decision?

14 A Our archaeologist would  
15 have to make that decision. You perhaps could direct  
16 that question to Dr. Reeves.

17 Q Dr. Reeves, could you tell  
18 us how you would define that?

19 WITNESS REEVES: In consultation  
20 with the government agencies and other special interest  
21 groups. Certainly, to get back to your question con-  
22 cerning the graves. As I say, to do it we need a little  
23 more information. The archaeologists who discuss this  
24 with interested groups on locations of potential borrow  
25 sources on the line itself, what stage it has to  
26 be done, It certainly has to be done in the case of  
27 sacred places besides burials . I mean we can look  
28 at the two kinds in areas of concern. It certainly has  
29 to be done before the line is final.

30 Q Now one of the other areas



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of concern, that you may be the person that the question  
should be addressed to, are what are called point bars  
in rivers and you are acquainted with that term, I take  
it?

7

A Yes.

8

9

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Q And point bars are areas  
which have been and in some cases still are very  
important for campsites. They are dry, they usually  
have widely spaced trees, often poplar or birch, depending  
on what part of the system your in and may have been  
used off and on for a long period of time for this  
purpose.

15

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20

The other thing they make is  
very good stockpile sites and there is and has been  
expressed a concern by the native people that those  
areas that they choose as campsites, you might well find  
your applicant choosing for stockpile sites and this is  
a terrain consideration.

21

22

23

24

Now, do you propose to identify  
these with the communities so that as much as possible  
the conflicts that arise with this, these competing  
uses of land, can be avoided?

25

26

A That, to avoid the question,  
is a social-economic question.

27

28

29

30

Q Well, it is a social-  
economic question in some ways, Dr. Reeves, but it is  
something that Mr. Bouckhout with all his wisdom may  
not be able to recognize. For example, you may agree



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with me that you can recognize some of these things from the air by the type of vegetation. You may be able to recognize them by the type of vegetation that would suggest that there had been dogs tied there over a season because there would be a change in the soil content because of the dog droppings.

And these are things that you might be able to help Mr. Bouckhout with in his socio-economic consideration. Is that not correct? Would you agree with me there sir?

A Yes.

Q Yes.

A Oh, yes in terms of identification and recognition of such things.

Q And I take it then in your informal meetings, Mr. Bouckhout, when your looking for this kind of possible terrain use conflict that you will have to use Dr. Reeves knowledge of this kind of occupancy location.

WITNESS BOUCKHOUT: Part of the process of finalizing all facilities locations and so on is to bring in the various disciplines to access the locations. Therefore, Dr. Reeves would obviously be brought in to access the various stockpile locations as so on.

MR. BAYLY: All right. Now, in a sense Dr. Reeves is right. It isn't strictly an archaeological site, but it may be one that can be



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identified by the methods he uses to identify likely sites that he would even like to dig in to find out whether they are good archaeological sites. So, it may be kind of a circular problem again.

THE COMMISSIONER: Dr. Reeves, Dr. Morlan said in his evidence-- Richard P. Morlan, he is with the National museum. I would assume you know him?

WITNESS REEVES: Yes, sir.

THE COMMISSIONER: He said that, he was talking about the northern Yukon, he said "In unglaciated areas which comprise nearly two-thirds of interior Yukon", now this was in connection with Arctic Gas' proposal to build a line across the Yukon to Mackenzie Delta, "In unglaciated areas, which comprise nearly two-thirds of the interior Yukon, there exists the possibility of discovering deeply buried sites of great antiquity which could rank among the most important finds in new world archaeology". And they had recently at Klokut, not far from Old Crow discovered a fleshing tool that they found was something like 30,000 years old.

Now, in the Mackenzie Valley, do you rank the Mackenzie Valley as on the same scale of importance as the unglaciated portions of the Yukon? In other words, are we talking about an area as important archaeologically, when we talk about the Mackenzie Valley, as we are talking about when we are



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3 talking about the Yukon because there you have an  
4 area that was never glaciated and it is also apparently  
5 the point of entry for man into the hemisphere. Is  
6 is-- Are the two areas comparable?

7 A In terms of present  
8 knowledge, certainly the Old Crow/<sup>Basin</sup>is very, potentially  
9 very important for finding remains of early man, because  
10 it is unglaciated. However, this potential does exist  
11 in certain sections of the Mackenzie where we may find  
12 such remains below the material left behind in the last  
13 glaciation or in areas which <sup>may</sup> have been outside the limits  
14 of the last glaciation.

15 The exact position, the exact  
16 extent of the last ice to come from the shield is not  
17 a matter of complete agreement among geologists. The  
18 potential is lower because of the fact that central  
19 Yukon is unglaciated but this potential does exist here.  
20 And also the Mackenzie Valley has been said by some  
21 archaeologists, well many, as another potential migration  
22 route for man into the interior. Either one, after the  
23 last ice age has receded, or two, before the last ice  
24 age advanced. It is a natural route.

25 Q Yes. By the way Dr. Morlan  
26 in his evidence told us about a bulldozer that was building  
27 an access road near Klokut and he said the  
28 Klokut site was disturbed quite badly by the  
29 construction of a winter road to Old Crow in 1969-  
30 1970. The road not only crossed the site but also ran



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3 along the site parallel to the Porcupine River for a  
4 distance of nearly 1000 feet. Over this entire dis-  
5 tance, that is a distance of 1000 feet and across a  
6 width of some 30 feet, approximately 400 years of the  
7 pre-historic and early historic record was removed by  
8 a single pass of / <sup>the</sup> bulldozer. It is interesting. It  
9 shows the damage that can be done and another interesting  
10 thing is that I don't think he said it in his evidence,  
11 I was just staying at the teachers' house with Dr.  
12 Morlan and he may have told me this privately over a  
13 cup of coffee, but there was an assumption that the  
14 construction crews are not concerned about anything  
15 except building the project.

16 But, Dr. Morlan told me that  
17 he met that bulldozer operator by accident and it  
18 turned out the operator was an amateur archaeologist  
19 who was quite upset to discover that he had been  
20 responsible for this damage. At any rate -- Well  
21 carry on Mr. Bayly.

22 MR. BAYLY: Yes, sir. Perhaps  
23 Foothills would like to get the name of that bulldozer  
24 operator from Dr. Morlan .

25 Two more questions for you,  
26 Dr. Reeves. One is there has been some mention of the  
27 possibility of removing potential archaeological material,  
28 or material containing archaeological finds, if they  
29 are suspected, as consolidated blocks from the trench  
30 and then taking them aside and dissecting them, if you



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3 will. Is that something that you have discussed with  
4 the engineers as a possibility especially if you find  
5 that the line goes through or near an area that you  
6 suspect may well be an important site?

7 A No.  
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I myself as an archaeologist don't think it's very feasible, particularly, I don't.

Q So you wouldn't anticipate that special consideration being given to a site. You'd say that Mr. Bouckhout's solution made more sense, and that is to build the pipe to go around.

A We're talking about the ditch?

Q Yes.

A The ditch is already there, they've already done their damage, immediate physical damage.

Q All right.

A I think I'll have to use an example, say --

Q Let's take this example, you start doing your ditch, because you're going to do a river crossing, and river banks are often places where people would camp because they had water, and often fuel and fish, and you get started into this and you say, "My goodness, we're in a site, but we're also in the best river crossing area and we've got the fish to think about and we've got the integrity of the pipe and we've got the cost and now along comes Dr. Reeves and tells us he wants some bones out of that material," and what I want to know is whether you've considered ways of removing this material so that the construction could go on but so that you



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1 could have your opportunity to investigate this site  
2 as well.

3 A Hopefully such conflict  
4 will be avoided.

5 Q But those are particular  
6 areas of conflict, that kind of example I gave is one,  
7 is that not correct?

8 A Potentially, yes.

9 Q So you -- will you be  
10 thinking about methods of getting around that kind of  
11 situation should they arise, because I suggest to you  
12 if you wait till the February/<sup>that</sup> construction starts, you  
13 may find it more difficult to start suggesting ways  
14 to get that out of there so that you can look at it.

15 A Oh yes.

16 Q And Mr. Bouckhout will  
17 help you, no doubt.

18 A No doubt, yes.

19 Q The other question I  
20 have is with regard to significance, and we've been  
21 told by Mr. Bouckhout that the question of significance  
22 will be determined by the archaeologist and you may  
23 immediately say this is a socio-economic problem, but  
24 there may be some things that the native peoples along  
25 the line consider are of significance, that archaeologi-  
26 cally you may /<sup>not</sup> considered to be significant and will  
27 you be figuring out your priorities for significance  
28 in consultation with the native peoples or their  
29 representatives?  
30

A Yes.



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Q And that will be one of  
the ways of determining what is significant.

A For those remains that  
are of concern.

Q Yes, and when we were  
referring before to that site at Fort Good Hope, and  
I personally don't know whether that hill that's known  
as Old Baldy has any say religious significance, but  
that's something that a person like you would be in a  
position to help find out before any determination was  
made as to whether it should be left alone or not.

A That's correct.

Q For example, its  
religious significance might be tied to the fact that  
it had been used over a long period of time for various  
human occupation purposes. Are you with me there?

A Yes. Well, there is  
evidence of that.

Q It just has to go on the  
record, and I see the nod, but it can't go on, that  
is onto the transcript.

A Sorry.

Q If I could ask a couple  
of questions about this question of aesthetics, Mr.  
Taylor, your task, I take it, is to either try and make  
sure that the pipeline route avoids areas of particular  
scenic beauty or grandeur, or that if the pipeline must  
go through these areas that it does so with the least  
damage to these areas from a physical point of view, or



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1  
2 if it does a lot of damage you have to be the person  
3 who is consulted as to how to clean it up. Is that a  
4 fair appraisal of what you have to do?

5 WITNESS TAYLOR: Yes sir.

6 Q All right now, what  
7 concerns me about your role is that there are some  
8 things that we've heard about aesthetics from Arctic  
9 Gas that make me feel that your role might be well  
10 nigh impossible in some ways. For example, we have  
11 hears from Arctic Gas through Mr. Hemstock, the head  
12 of their environmental group, that there are two ways  
13 of looking at northern landscapes, and he says to some  
14 the untouched and pristine wilderness may be the thing  
15 of ultimate beauty, while to others a pipeline right-of-  
16 way breaking the otherwise unbroken forest canopy may  
17 alleviate the boredom. I don't think boredom is the  
18 word he uses, but that's the basic idea. I gather  
19 you face these same kind of conflicts in your study of  
20 the area, or perhaps you take a different viewpoint  
21 from that expressed by Arctic Gas.

22 A Yes sir, you have to  
23 identify what group, let's say you're most concerned  
24 with or are concerned with, the people in the area,  
25 living in the area of course are most concerned with  
26 are used to the wilderness quality of the environment.  
27 People from the south of a more transient nature,  
28 roadways, facilities and so forth are comforting to  
29 some degree to see that man has had some influence on  
30 the environment and that man is there. So personally



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1 I try to look at it from both points of view but I  
2 think the wilderness quality is probably the most  
3 significant consideration, and the attempt to minimize  
4 the impact on that quality is the way I design my  
5 approach, rather than highlighting the impact or  
6 making the features of the project available, most  
7 available to potential viewers.

8  
9 Q Now, when we talk about  
10 potential viewers, we have two kinds that I can think  
11 of readily, and they are what Mr. Scott has described  
12 as the people who fly over it many thousands of feet  
13 in an aircraft, and the people on the ground, and what  
14 may appear to be a scar or visual relief to one may  
15 not affect the other. Is that not correct?

16 A That's true.

17 Q And so that you have to  
18 decide who you're going to plan for, and maybe you  
19 can tell me, are you going to plan for the visual effects  
20 of the person coming into the north by air, or are you  
21 going to plan your aesthetics for the people who will  
22 be here long after you're gone?

23 A Well, there's very  
24 little that can be done from the air because of the  
25 absolute visual accessibility that you have. On the  
26 other hand, in terms of gaining visual accessibility  
27 to features of the development from ground level, there  
28 are quite a number of techniques you can use, so that's  
29 I think where we put our emphasis, looking at locations  
30 that would not be as visible from ground level.



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Q So in other words you  
could leave a screen of trees around the gravel pit  
so that you couldn't see it without going right up  
to or into it, but you could still see it from the air.

A That's correct. That would  
be a                    that  
/ technique / could be used.

Q All right, now one of the  
says  
things that Arctic Gas / at Volume 14-DM, tab 2, page  
3, item 2.1.5, under "Conclusions" on the question of  
aesthetics, and I just invite you to comment on, or agree  
or disagree with this statement, is,

"The degree of direct visual impact depends on  
the extent of public exposure. In the remote and  
largely undeveloped territories through which it  
passes the pipeline development will be seen by  
few people and the impact on the viewing public  
will be of minor proportions."

Is that a philosophy you take with you when you are  
discussing the aesthetics for Foothills?



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1  
2 A That's an element of my  
3 philosophy. It certainly isn't the most major con-  
4 sideration.

5 Q Isn't one --

6 A We've been concerned that  
7 as to potential land uses as well such as proposed or  
8 envisioned provincial parks, or territorial parks I  
9 should say, so we're trying to take into account what  
10 areas may be sensitive to populations in the future  
11 as well as in the present, so because an area is basical-  
12 ly undeveloped or inaccessible today, we were trying  
13 to utilize what available planning information there  
14 is to predict how successful that might be in the  
15 future, so an area that is undeveloped today might be  
16 in some cases as sensitive, or as important in our  
17 considerations as the existing developed zones in the  
18 valley.

19 Q Well, one of the things  
20 this suggests to me is in my interpretation of it is  
21 that wilderness value increases with public exposure.  
22 And I suggest to you that that's one of the paradoxes  
23 of wilderness that the more public exposure it gets, the  
24 less wilderness it is.

25 A It is a paradox of  
26 aesthetics as well because again aesthetics is a function  
27 of human perception. If you have a zone where it is  
28 virtually inaccessible or not used, aesthetics from  
29 a human point of view would not enter in.

30 Q All right, but if we



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1 take this at this statement in the most cynical way  
2  
3 and I don't mean to suggest to Mr. Marshall that that's  
4 the way in which it was meant. It could be taken  
5 as far as to say because not very many people go there  
6 it doesn't matter very much. And is that a philosophy  
7 with which you would subscribe?

8 A No.

9 Q So you feel that the  
10 wilderness areas may be important, even though no man  
11 may see them from one year to the next.

12 A That's right. There are  
13 a number of paradoxes here obviously. If you take, as  
14 I said earlier, aesthetics in its purest definition, it  
15 has to rely on humans perceiving some element of the  
16 landscape.

17 Therefore, areas that are  
18 let's say, one person or no people have access to  
19 in over a period of the year, as far as interaction  
20 with humans go, this area is less important than let's  
21 say, an area two miles from Yellowknife where two or  
22 three thousand people see this same, or another feature  
23 every year.

24 Q Well, part of seeing  
25 doesn't involve going there, I put it to you, that  
26 because we now are able to take into people's livingrooms  
27 or movie theatres views of wilderness which does exist  
28 without having to go there, but wilderness may have a  
29 value to people even though they neither go there nor  
30 ever intend to go there? So that the visual impact



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of it can be transported to them rather than having  
to transport them to it and that may give it a value  
despite the fact that very few people ever go there.  
Is that not fair to say?

A I would agree.

THE COMMISSIONER: Let me  
take that one step further. You can tell me whether  
this something that comes within the aesthetics. I  
was going to say within the science of aesthetics and  
then I was going to say the art of aesthetics but  
I decided I had better just say aesthetics.

MR. BAYLY: Perhaps the  
business, Mr. Commissioner.

THE COMMISSIONER: There are  
some people who have written about Canada, Canadians  
who have written about Canada who say that Canadians  
think of themselves as a northern people even though  
only a very limited number of them live in the Arctic,  
in the sub-Arctic but that their own notion of their  
identity as Canadians, their own sense of the complete-  
ness of Canada is based on the assumption and upon  
the knowledge that there is a great untouched northern  
wilderness, that it is in a sense a part of their own  
notion of Canadian identity. I'm not doing justice to  
the people who have expounded on this concept, but is  
that something that in aesthetics that comes within  
aesthetics and if it does come within aesthetics, does  
it have any validity, or do you wish to comment on  
that?



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A I think perhaps from a philosophical point of view, it has some validity. I think it has to be contrasted though with an attitude of many southern peoples that the north is there to be developed and exploited and I think probably a greater percentage of people in the south would get perhaps satisfaction from that point of view.

Q Well, would the latter --?

A It is a very complicated --

Q Would the latter fall within aesthetics as well?

A No. I wouldn't think so. It's more of a national attitude and I think perhaps what you indicated earlier falls more in line of attitudes, social attitudes.

Aesthetics vary considerably, related on the background of the people that perceived a given element that we're say concerned with and very little work has been done related to let's say northern populations or native populations as to what their aesthetic values might be. There have been some assumptions.

There has been very little work done though by social psychologists and environmental psychologists in qualifying what native attitudes are towards aesthetics and change.

There has been a little bit of work done in Alaska but nothing conclusive as to how the various people relate to development



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1  
2 or to wilderness areas.

3 Q Would you not agree with  
4 me, sir, that in some cases then and dealing with the  
5 matter of attitude that wilderness becomes, as an  
6 aesthetic value more valuable to people when they  
7 realize that they either have lost it or are losing  
8 it. People flock to wilderness from areas where  
9 there isn't any.

10 A That's true. It's a  
11 matter of scale. For instance, an area of wilderness  
12 is much more important or significant in United States  
13 than, say a given area in Canada because of  
14 quantities available.

15 Q Well, you as a person  
16 involved in this study of whatever we may call it must  
17 take that into account. I submit to you that you  
18 must plan for the potential loss of this in deciding  
19 what value it has and it's something that once you  
20 have lost, it's very difficult to get it back.

21 A That's correct. I might  
22 add though that if you're looking at the Mackenzie  
23 Valley in the degree of development and exploration  
24 that has already been done, when you consider seismic  
25 lines, CNT lines, highways, and other development,  
26 you can't, at least from the air, call this corridor  
27 pristine. In fact, in flying it myself, there are  
28 very few times that you don't see <sup>in</sup> a landscape some of  
29 man's influence.

30 Q Certainly, I would agree



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1 with you there but I'm suggesting to you that that does  
2 not mean that you can extend that argument to saying  
3 that because say an Eskimo leaves a gas barrel on a  
4 beach that therefore what he really deserves is an  
5 oil refinery.  
6

7 You see the absurd  
8 extension of that argument that man is a person, or  
9 is a creature that puts his mark on the landscape  
10 whatever he does. That does not mean that there is  
11 not some value that you, I assume, are taking into account  
12 of trying to minimize the visual impacts anyway of  
13 that, going hand in hand with development, because after  
14 all you are not only a person trying to protect the  
15 aesthetic values that remain in the Mackenzie Valley  
16 but you are also hired by an applicant who wants to  
17 put a major transportation facility in it, so you have  
18 to try and balance those off. Is that not correct?  
19

20 A That's true. What I was  
21 getting at earlier is that in balancing this wilderness  
22 in quotation marks with say other wildernesses in the  
23 north, this is a fairly. There has been a lot of  
24 activity in this corridor that is expressed in a visual  
25 way and when you superimpose this development, it seems  
26 to me fairly minor as compared to other developments  
27 such as highways and --

28 Q Yes, but that is no excuse  
29 for not doing good aesthetic planning of developments  
30 that will come after even if the ones before have not  
been as good as you would have liked. Is that not



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1  
2 fair to say?

3 A I think that's fair.

4 Q Now, one of the things  
5 that interest me and people especially in the delta  
6 is seismic lines and an interesting example of this  
7 was brought up by some of the Inuvik people of the delta  
8 and that is that there were proposals for seismic lines  
9 to run triple seismic lines in certain areas.

10 Now, that proposal that  
11 is one line, or three lines parallel to each other.  
12 Now, that proposal was turned down on aesthetic grounds  
13 in favour of a herring bone pattern of seismic lines.  
14 That is, a single line with lines like tracks of  
15 ptarmigan if you like going off to either side of this.  
16 Now, what are the aesthetic considerations that go into  
17 that kind of a judgment, because I assume those are  
18 the sorts of things that you will have to deal with on  
19 a day-to-day basis in this project.  
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2 A I think it probably re-  
3 lates to the linear aspect of these cuts. First the  
4 herring-bone sort of pattern to me implies that you're  
5 going at right angles eventually, and any view you  
6 have down this corridor isn't an endless sort of thing.  
7 If you have a triple line, you might, as you transect  
8 the seismic line, you would be able to see down to  
9 infinity, let's say, and then you walk over it further  
10 and you see down to infinity again and again. So that  
11 the impact is probably -- the judgment there is probably  
12 good because it would reduce the impact.

13 Q Too much infinity would  
14 be a bad thing.

15 A I think so, in a heavily  
16 forested situation. There are other people from other,  
17 you know, that might relate to that in a very positive  
18 way. It's been said that people from the prairie areas  
19 of Saskatchewan, for example, when they get into Shield  
20 areas or very heavily forested areas they are quite  
21 uncomfortable, and these seismic lines could be a  
22 relief.

23 Q Well, does that mean then  
24 that if Foothills has hired a man who is an expert in  
25 aesthetics like you, who is from Alberta and perhaps the  
26 prairie regions, that your aesthetic judgment would  
27 be for lots of infinity whereas if they hired one from  
28 the mountainous areas of B.C. we might get quite a  
29 different pattern? What I'm suggesting to you by  
30 examples that may sound absurd is that the aesthetic expert



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imposes his own personal bias on how things should be  
done, based on his background as well as his education.

A Well, hopefully in this  
case it's more an element of education rather than  
personal preferences or personal exposure.

Q All right.

A So I think in my approach  
I attempt to review the state of the art and then  
apply techniques that seem to be generally accepted from  
our professional point of view.

Q Well, Mr. Taylor, here's  
my problem, and it's that you're a man with training  
in this discipline, but you come to it with southern  
perspectives and <sup>you'll</sup> / leave after it's all over, having  
imposed what you in your best judgment, think are the  
best aesthetic principles. Now what I'm concerned with  
is how much input you are going to try to get from the  
people who will remain after you have gone, because  
they are the ones that will live with your aesthetic  
judgments; is that not correct?

A Yes.

Q And what plans do you  
have to ask the Indians, the Eskimos and the white  
people living in the north what they think aesthetically  
would be the best way to do some of the things that  
you will want to carry out to minimize the visual  
impacts of the project and its related facilities?

THE COMMISSIONER: For instance,  
the restoration of gravel pits and gravel mining



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1  
2 operations which many of them would be fairly close  
3 to communities where native people live. This is a  
4 good point, I think, because the question arises whose  
5 notions of what that gravel pit ought to look like  
6 what its function ought to be after it has been re-  
7 stored will prevail, yours or the people who have to  
8 live with the gravel pit? In Southern Canada, except  
9 in rare cases, they don't ask local people what this  
10 gravel pit ought to look like after the gravel has been  
11 removed. I know they don't do that, but the people who  
12 are designing the restoration are probably more likely  
13 to think in the same way and to have the same notions  
14 of what it ought to look like as the people who live  
15 there, and that isn't so here where southerners have  
16 as you just conceded, really never considered what the  
17 aesthetic notions of northern peoples are.

18 Well, we're putting you on the  
19 spot here but --

20 A Well, just to carry your  
21 point a bit further, we in fact are in the south, on  
22 projects such as highways, in urban areas or in rural  
23 areas trying to -- are meeting with the communities  
24 affected or the public affected, to try to create  
25 exhibits in terms of what this facility might look like  
26 and what the alternatives are. This is in the case of  
27 two freeway projects we're working on in Calgary now,  
28 and these options are presented to the public to  
29 affected community people and feedback is obtained.

30 We have no process, or I haven't



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1  
2 personally any process like this for this project,  
3 although there seem to be a number of issues such as  
4 the priority for borrow pit sites and other related  
5 land use issues that I could visualize being taken on  
6 a site specific way to interested community groups.  
7 But I can't detail any program. It has validity.

8 THE COMMISSIONER: This is not  
9 quite the same subject, but you contrasted neatly  
10 earlier this morning attitudes of Southern Canadians  
11 toward the north. Some might think of it as a region  
12 that could only fulfill its destiny, so to speak, if  
13 it were exploited and developed, if oil and gas,  
14 minerals, timber, all that it could provide were to  
15 be removed; while others would require some kind of  
16 emotional satisfaction from knowing that it remained  
17 there where it still does, pristine and untouched.  
18 If you look at the evidence given at the community  
19 hearings the Inquiry has held in something like 20  
20 native communities so far, Indian, Metis and Inuit,  
21 you will see that many people in those communities  
22 speak of the bush, which -- as something from which  
23 their whole notion of themselves is derived in a  
24 large measure that is really difficult for us to  
25 appreciate. The destruction of the bush, certainly  
26 it has occurred already in many instances owing to  
27 seismic cuts, but no one has ever said, "Well, what  
28 do you think of this?"

29 And having been asked, the  
30 answers are very revealing and many people in these



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1  
2 communities use the analogy of the loss of a limb,  
3 cutting of -- they felt that destruction of the bush  
4 was something like the cutting of their own flesh.  
5 I only mention that because you might, if you haven't  
6 already looked at some of those transcripts you might,  
7 because it gives an insight into the way that northern  
8 peoples, native peoples certainly, think. Not all of  
9 them, I don't suppose, but certainly that's the pre-  
10 dominant theme made explicit by people asked to say,  
11 "What do you think of this?" It's worth reading.

12 Well, I think --

13 MR. BAYLY: Those are all the  
14 questions I have, sir, if you are looking for a time  
15 to have coffee.

16 THE COMMISSIONER: I was  
17 thinking I should stop talking.

18 MR. BAYLY: I felt the same  
19 way, sir.

20 (LAUGHTER)

21 I was thinking about myself.

22 MR. MARSHALL: I was just  
23 wondering, sir, what the plans are for this afternoon,  
24 whether it's intended that we sit? I gather Mr. Scott  
25 may be leaving us this afternoon. Are we to adjourn  
26 at one?

27 THE COMMISSIONER: Well, what  
28 do you say?

29 MR. SCOTT: Mr. Commissioner,  
30 the arrangements were made earlier in the week to stop



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at one on the assumption that Mr. Marshall and Mr. Gibbs, and Mr. Gibbs especially, could not be here this afternoon. Arrangements have been made so that Foothills is fully represented.

MR. LUTES: Our preference is that if there's any possibility to finish this Panel 2 to stay this afternoon and finish.

MR. MARSHALL: P.W.A. has arranged that I will be here until this evening.

MR. SCOTT: I don't think there's any real possibility the panel can be finished today in view of what my friends have said, but I'm quite willing to try.

THE COMMISSIONER: All right. Well let's just carry on till 12:30 in the usual way and come back at 2 and see how far we get. Is that -- we'll do that, but you gentlemen discuss it at coffee with the panel and if you want to work out something else, that's all right, we'll do that. We will adjourn for coffee.

(PROCEEDINGS ADJOURNED FOR A FEW MINUTES)



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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR.BAYLY: Q I thought I had finished,  
but Mr. Marshall reminded me that I had asked Mr.  
Lawrence some questions that he has apparently been  
working long into the night on and it would be  
unfortunate if he didn't tell us what the answers were.  
Mr. Lawrence, they are on the site of the Komakuk Beach  
planned  
Camp facility / by Arctic Gas. Can you tell me  
what sorts of sewage treatment possibilities you  
had envisaged for a site of that nature, or for that  
particular site given the observations I made yesterday  
about it as being on a beach, close to a single lake,  
and a single river and also close to the Beaufort Sea?

WITNESS LAWRENCE: Well sir,  
I am glad you said possibilities because this points out  
the fact that in order to do a proper job of this, it  
would be required to make a site visit for one thing,  
possibly more, It depends on the season of the year.  
You need far more information than I have here.

However, the general guide  
that we set out seem to apply very, very well. First  
of all, we would go into a mechanical treatment plant.  
This would be biological or physical chemical. The  
disposal of the water after, I think is a thing which  
I would not try to make up my mind based on the information  
I have.

There are two possibilities  
on land. In fact, there are three possibilities, on



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1  
2  
3 land, in the stream or into the sea. Based upon my  
4 knowledge of this particular area, and I haven't visited  
5 this particular area, but I have further on up the coast,  
6 I would see nothing wrong with disposing of the treated  
7 effluent directly into the sea. The integrity of the  
8 pipeline leading out would be a thing that would concern  
9 me. But neither would I be concerned about disposing  
10 it into a muskeg areas inland. I think that is the  
11 answer that you were looking for.

12 Q Yes. And I gather from that  
13 that you rule out sewage lagoons, in this kind of area?

14 A I think in so far as the  
15 pipeline is concerned the position of the sewage lagoon,  
16 does not play a very prominent part. A sewage lagoon  
17 means that you are going to disturb an area, you are  
18 going to build up something which is going to be  
19 restored afterwards. This is the type of thing we are  
20 going to try to avoid in so far as possible.

21 Where a lagoon or a pit or  
22 a holding pond can be built as part of the pad, then  
23 I think this is fair game, because this is something  
24 which will last as long as the pad is in use. But this  
25 area here is a staging area and a camp area which does  
26 not form part of the permanent pipeline facilities and  
27 I think that the mechanical plant which could be removed  
28 afterwards, the outfall line which could be removed  
29 afterwards, with very little onshore facilities, would  
30 be the thing I would favor here.



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Q Yes. Now, with regard to  
the use of lagoons, my understanding is that lagooning  
in Alaska on the Alyeska project just haven't worked,  
just haven't been a successful form, or a successful  
element in the treatment form? Is that your understanding?

A Yes, that is my understanding.

Q What went wrong.

A Well most of these are  
mobile arrangements and I think under design hydraulically  
is the major item.

Q When you say under design  
hydraulically, could you explain that in sort of people  
terms.

A Well, a good lagoon by  
anyone's standards should retain the sewage sufficiently  
long, so a treatment process could be developed and in  
anyone's language in our areas, this is one year's  
retention. Now, this means<sup>a</sup>/multi-cell type of thing  
too and so you have got two functions going. A  
deposition of sludge, a separation of sludge, plus  
a sufficient long retention so<sup>a</sup>/secondary treatment with  
effluent can take place naturally. Now, if either one  
of these elements are missing, then something else  
has got to take its place. If you can get rid of the  
sludge and then dispose of the liquid into a stream  
large enough to absorb the impact of the B.O.D.,  
suspended solids, no problem. I think the major thing  
is that in none of<sup>the</sup>/Alyeska ones did they provide for



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1  
2  
3 sufficient retention to have this take place.

4 Q Could I sort of interpret  
5 that as meaning that they were too small?

6 A Yes.

7 Q Now, one of the other areas  
8 that you covered yesterday was water supply and so that  
9 we don't leave an incomplete impression, Associated  
10 Engineering has not done a great deal of work in this  
11 area, but as I understand Blench and Associates have  
12 done some work which may mean that the state of know-  
13 ledge is greater than you indicated yesterday. Is  
14 that the case?

15 A Yes, his report though is  
16 in general. I think if you look at parts of it, he  
17 takes a section of maybe 75 miles, and says that in  
18 this area there is no shortage of water. Now this is  
19 the same type of study which we did.

20 Q So it was, in other words,  
21 the same thing for a different area that you did but  
22 it doesn't go beyond the level that you went basically.

23 A Well, we participated with  
24 CAGSL Group in a section by section analysis of the line,  
25 a year and a half, two years ago, and we have also had  
26 a look at the line of Foothills and looked at the maps  
27 and I think this has satisfied us in general that where  
28 the proposed, plus or minus two or three miles of  
29 building their compressor stations and therefore their  
30 camps, we see no real problem of obtaining a supply, an



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adequate supply of raw water.

Q Yes. Now, if I can go back again just for a moment just to these portable sewage lagoons. The fact that they are too small on the Alyeska project, I take it does not necessarily mean that you would rule them out as a possible recommended procedure?

A No, particularly as a backup.

Q So, you would use that in case the size of the camp increased? That would give additional capacity for example? Is that what you mean by backup, or in case something broke?

A In case something broke or the operator wasn't on the job. I think it is quite important to say that if the camp sizes increased, then the component, the treatment component for that portion of a camp or that size of a camp will be added together with this. The same as a kitchen. I would look at it in the same way as I would a number of sleeping quarters or a kitchen unit. That this would be a standard package. Every-- For example, two hundred men will have a treatment component sized for its use.

Q I see. Now, yesterday just as I was finishing my cross-examination of the panel for the day, I was handed by your counsel a report of Associated Engineering Services Ltd. called "Foothills



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Pipeline Ltd., Typical Treatment Units for Arctic Work  
Camps, November, 1975". And I looked through this and  
it starts off with some pictures of trucks at Fort  
Good Hope and then gives what, without trying to be  
unfair, I would suggest are manufacturers diagrams of  
some sample units that may or not be applicable to  
particular camp situations. Would that be fair to say?

A Yes, the purpose of  
putting that pamphlet together was because when you  
talk of a package unit this may mean something to me  
but may not mean anything to counsel. So, to just to  
kind of pictorially show a person what these things  
mean or look like, we put that pamphlet together. I  
have other copies for the Commission if they so wish.

Q All right. So, we shouldn't  
take this as a design document. It is really an  
illustrative document so that when you are talking about  
package units, disposal trucks etc. we will be able to  
see diagrammatically or pictorially what is meant.

A Yes, it is like a dictionary.

Q Yes. Mr. Commissioner, if  
there are these things it might be suitable that one  
were filed as an exhibit so that when the subject comes  
up, you will have the benefit of the pictures that I  
have.

THE COMMISSIONER: All right  
it will be marked.



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(FOOTHILLS PIPE LINES LTD., "TYPICAL TREATMENT  
UNITS FOR ARCTIC WORK CAMPS, NOVEMBER 75", A.E.S.  
MARKED AS EXHIBIT 312)

Q Those are all the questions  
that I have sir. Thank you very much panel.

MR. MARSHALL: Just before  
Mr. Carter begins cross-examination of Arctic Gas, I thought  
I should mention is that there had been some requests  
for information on the delta environmental protection  
unit that is run by the producers and Mr. Hemstock  
was able to obtain some information and I have given  
a copy of that to Commission Counsel and also to Mr.  
Bayly. Maybe some of the other participants are  
interested in it as well. Mr. Hemstock indicated that  
this a subject that we intend to pursue when we get  
to the cross-delta phase so I don't propose to enter  
this as an exhibit at this point in time. The material  
is available.



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THE COMMISSIONER: Fine.

CROSS-EXAMINATION BY MR. CARTER:

Q Mr. Vaartnou, if I could, I'd like to deal with the matter of re-vegetation which you spoke to and to begin with I'd like to ask you about the differences that you pointed out in the approach of Arctic Gas and your own, and as I understand it, in your view Arctic Gas is not as optimistic about the use of native grasses and are proposing to use agronomics, whereas you on the other hand will use native ecotypes and naturalized landraces of agronomics, is that correct?

A  
WITNESS VAARTNOU/As much as I understand, not they are/optimistic to produce the seed. They would like to use the native material if available, if my understanding is correct.

Q All right. Something that isn't completely clear in my mind, and that is the difference between -- to use your terminology -- naturalized landraces of agronomics and the agronomics that Arctic Gas has talked about.

A You would like me to explain the difference?

Q Please.

A Agronomic varieties is usually developed for the purpose of forage quality, quantity, or beautification of the lawns. Now, there is difference. If the same species, or the variety is introduced in new area are less than, as much as I



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Cross-Exam by Carter

1  
2 hope you know what every cross-pollinated grass, each  
3 plant comes out from the seed is different, that the  
4 variability size of that so-called variety we could  
5 consider it significantly, each plant might be different  
6 acting differently in various micro-environmental  
7 conditions.

8 Now, if we leave that variety  
9 in that area on that environmental conditions, if we  
10 say 50 generations, within that 50 generations the  
11 nature selects out and kills out those plants what's  
12 not to that environment and only those plants what  
13 genetically and environmentally are adapted on that  
14 specific site specific condition would survive  
15 there. Now, when you come back say, after 50 or 100 or  
16 10,000 years to that location, you could select so-  
17 called landrace. It/<sup>means that</sup> plant is not native but this  
18 is introduced and the landrace is selected by the  
19 local environment to be useful to that area. Is it  
20 sufficient?

21 Q I think I understand.  
22 Now, you say that agronomics have been developed for  
23 uses of forage or lawns, is that correct?

24 A Yes. Most of the grasses.

25 Q But that in itself isn't  
26 a disadvantage when it comes to using grass, say, for  
27 erosion control. The mere fact that it's been developed  
28 for that purpose doesn't rule it out for other uses.

29 A No, not at all.

30 Q Now, from your testimony



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1  
2 I took that there were at least two important things  
3 that you found wrong with agronomics. The first one  
4 was that they do not provide a permanent ground cover,  
5 and the second one was that they hinder the development  
6 of natural re-growth.

7 A I said they might hinder.

8 Q And in your view that's  
9 important because a major objective for you is to  
10 develop a self-supporting ecosystem.

11 A That's correct.

12 Q I wonder if I could  
13 refer you to the Appendix "C" where you refer on page  
14 3 to your objectives, and here you refer No. 1 to  
15 the restoration of a self-supporting ecosystem. Do I  
16 take it from that that's your first objective?

17 A That's correct.

18 Q And No. 2 is erosion  
19 control.

20 A That's correct, because  
21 I don't expect that land for vegetation could be only  
22 part to control erosion. I expect the vegetation could  
23 help to reduce the surface erosion caused by wind and  
24 some precipitation. But it would not control the  
25 surface erosion caused by running water. Plants,  
26 when established, are weak for at least one year and  
27 running water erosion must be controlled some other  
28 means.

29 Q But if you could develop  
30 plants, even be they agronomics, that develop quickly



Bouckhout, Drew, Claridge  
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Cross-Exam by Carter

1  
2 to provide an erosion control in the short term,  
3 wouldn't that be an important factor that you'd be  
4 looking for in re-vegetation?

5 A It could be, but sir,  
6 I don't know any plant what would grow within six  
7 months to that stage where that you could stop the running  
8 water. I'm sorry, in my lifetime I have not seen  
9 anything like that and I don't expect anybody can  
10 develop the young plants which <sup>could</sup> survive if there is  
11 inch of water or three inches of water, for 24 hours,  
12 and if the water running in the one channel and it  
13 could stop, any growth could be washed out.

14 Q All right, I understand  
15 that you can't develop them within 24 hours, but there  
16 must be a difference amongst different species and  
17 varieties in how long it takes them to develop the  
18 capacity to control erosion. Is that not correct?

19 A Do you mean how long it  
20 takes the plant to grow to stop that and not to  
21 develop the species?

22 Q To grow, yes.

23 A Yes. Now I guess you  
24 know it takes at least one or two weeks to germinate.

25 Q Yes.

26 A It takes at least a month  
27 in any grass to be half an inch tall.

28 THE COMMISSIONER: To be what?

29 A Half an inch tall.

30 Q Half an inch tall?



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1  
2 A Yeah, and it takes least  
3 one summer to grow it up to three to four feet, if  
4 possible, but usually <sup>north</sup> / , it would get six inch to  
5 one foot growth would be most what we can expect in  
6 first summer. Normally not.

7 MR.CARTER: Q But some would be faster  
8 than others, wouldn't they?

9 A Oh, sure.

10 Q Would there not be some  
11 agronomics that would be faster than the native  
12 varieties and species that you referred to?

13 A I completely disagree.  
14 Some natives would be faster than any agronomics  
15 I have seen.

16 Q In providing erosion  
17 control?

18 A Neither of ~~them~~  
19 provide the early erosion control on running water.

20 Q I understand that they  
21 don't provide it right away, but are there not some  
22 agronomics that would provide erosion control earlier  
23 than natives?

24 A What you mean by "native"?  
25 Specify ~~the~~ species.

26 Q Well, you have made the  
27 distinction between agronomics and your --

28 A On that point I ~~would~~  
29 like to know to which species you refer, then I will  
30 reply.



Bouckhout, Drew, Claridge  
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Q I'm not referring to any species. The question is, are there not some agronomics that would develop the capacity to control erosion sooner than natives, using your definitions of those two terms?

A If you refer the Arctic Gas definition of "natives" ~~arctagrostis~~ and calamagrostis canadensis, it takes three years usually to properly develop, then some natives would be faster. If you talk some of it like poa palustris or agropyron trachycaulum or some other natives like bromus ~~pumpe~~llianus and in certain conditions they grow as fast as any agronomic species.

Q Do they develop the capacity to control erosion as fast?

A Yes.

Q Have you done any studies on that?

A Yes.

Q Where?

A From my experience when I was in Beaverlodge and right now in, doing it in Alberta.

Q What -- could you describe the studies that you've done at Beaverlodge that dealt with erosion control?

A They were not designed for erosion control. If you remember, Beaverlodge Research Station established <sup>a</sup> study area at Inuvik, 1956-57,



Bouckhout, Drew, Claridge  
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Cross-Exam by Carter

1  
2 using agronomic varieties in some areas, and this was  
3 discontinued 1967 when I visited that area and it was  
4 established on slope, on that hill on city there or town  
5 and that's the one that I could point out right now that  
6 applicable to the northern environment.



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Q And that is the only one?

A Yes. Other areas in  
research station and at Fort Simpson here was being  
used as a research station in that area and others  
areas Slave River lowland / <sup>was being used</sup> to test agriculture  
varieties and compared to the native species.

Q The question that I was  
putting to you was whether you had studies to back up  
your statement that certain native species develop a  
capacity to control erosion just as quickly as agro-  
nomics. And you stated that you had those studies  
at Beaverlodge but now, I take it that you don't.

A I qualify it. I was  
stationed in the Beaverlodge Research Station as a  
research scientist at that time and I did survey that  
way and evaluated the sites, handled it through the  
Beaverlodge Research Station.

Q Yes.

A It was not in my personal  
research site, other people handled that. But as a  
forest ecologist, I was called in to evaluate the  
site.

Q Was there any report  
done that one could use to determine how long it  
took the natives to develop this capacity control  
erosion as compared to agronomics?

A As much as I know. Those  
reports are reported on Beaverlodge Research Station's  
annual reports. I don't know exactly how detailed



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Cross-Exam by Carter

1  
2 because I was not responsible that my personal work  
3 would be evaluated first time this winter what we  
4 started in 1974 and it would be carried out next ten  
5 years and the final report we expect to get then.

6 The first report would  
7 be next spring available.

8 Q And they have been designed  
9 these tests that you developed in 1974 to study this  
10 problem of erosion control?

11 A Yes, partly erosion  
12 control, partly they are designed and established to  
13 evaluate native naturalized landacres and agronomic,  
14 agronomic varieties for erosion control and non-main-  
15 tained disturbed areas in Alberta.

16 Q And where is this study  
17 taking place?

18 A This is right now the  
19 fiftieth research site that's established sites across  
20 in six different environmental districts in Alberta  
21 we're and trying to select the most difficult soil types  
22 and the most severe conditions for reclamation  
23 purposes.

24 Q And these are all in Alberta?

25 A Yes. No, that's not all  
26 Alberta. Two are right here, in close to Yellowknife.

27 Q Where at, sir?

28 A Great -- what's that name  
29 of that mine? Giant Hill, and one is Pine  
30 Point.



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Q The only two sites in the  
north are the mines at Yellowknife and Pine Point?

A That's my personal, yes.  
what's  
There are other sites / there but they are not under  
my contract. But I have access to evaluate those ones.

Q So, just that I understand  
correctly then, you rank in your objectives the  
restoration of a self-supporting ecosystem ahead of  
erosion control?

A Yes.

Q Now, you are being more  
optimistic about your approach, I take it depends on  
two things. First of all, your optimism in being able  
to produce the seed necessary to re-vegetate the  
areas that you wish to re-vegetate and secondly, your  
optimism that in taking these seeds back to the north  
and replanting them they will meet the objectives of  
the re-vegetation program?

A Yes. Basically, I  
started that work about 23 years ago and first I have  
been quite pessimistic about some of them as Dr. Younkir  
remembers. We discussed it a couple of years ago on  
some species, some northern ecotypes. There was some  
difficulty to obtain economic amount of seed, useful  
seed, but there has never been problems as we say, I  
work about 75 species. I would say I had some prob-  
lems with 5 species from that point of view. The other  
70 species I didn't have any problem.

Some of them like



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Hierochloe, I had to develop so called stratification methods to handle the seed before planting. Now, last year, we obtained quite a good result as we already will be able to get 50% germination. We are still working and expect to increase that one to modifying their stratification methods to improve the germination percentage.

Now, the other species like some of the self-fertile species, like Slender wheatgrass, there you have to consider that the variability does not exist in that selected. I mean if you selected the material, there is not, it is not cross-breeding. It means the plants are uniform. It means to get some variability, you have to go to the field and select a different ecotype to be able to produce. Some ecotypes can be produced in certain environmental conditions. Some of the same species collected maybe 25 miles apart are not able to do it. But so far we have been quite successful and we could get Slender wheatgrass, northern ecotypes would produce maybe 3 or 400 pounds per acre. Others are able to produce only 50 pounds.

Normal for Slender wheatgrass is a thousand pounds. So, we realize the fact that some ecotypes produce less seed. It means the seed would be a little bit more expensive but it is possible to do it.

Q Where have you produced a thousand pounds per acre?



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A All the agronomic  
varieties could produce thousand pounds in the states.  
I guess that is the reason you get it so cheap.

Q So you are not suggesting  
that you have produced a thousand pounds per acre?

A No. I don't. I mentioned  
up to 2 or 3 hundred.

Q Have you done that?

A Yes.

Q Where was that?

A At Beaverlodge and High  
Level.

Q How many acres had you  
seeded of the native species?

A No, I talked of the  
research station I have got five, two, ten,  
twelve acres seeded.

Q Of native species from the  
Northwest Territories?

A Native species and natural  
landrace Not only from the Northwest Territories.  
I have some five rows by a hundred feet test plots for  
all of them what I plan to use and that will produce  
enough seed to start. And I could get the figures  
when the seed is properly--this was already harvested  
this year and last year. And I could get exact figures  
by acreage point of view this winter when the seed  
is cleaned and properly crushed

Q But these are from plots.



Bouckhout, Drew, Claridge,  
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Taylor, Reeves  
Cross-Exam by Carter

1  
2 These are not acreages you are talking about. 200  
3 acres --

4 A Yes, sure. If you dealing  
5 with field and research plots. If you  
6 do something on the same say a greenhouse, to me, you  
7 forget it. It's not applicable most of the time for  
8 the people. If you do it in a small plot in the field  
9 you usually go and try to do it field scale. Use 25%  
10 of data and you are very good.

11 Q I see.

12 A Don't expect a hundred  
13 per cent.

14 Q You take your success in  
15 a small plot and you figure that --

16 A 25% of that and you could  
17 get in field conditions.

18 Q I see. Now, the seed that  
19 you have collected. You mentioned you had collected it  
20 along the Mackenzie Valley and the Yukon, I believe.

21 A Yes.

22 Q Could you tell us where  
23 these different ecotypes have been selected from?

24 A You want the names of the  
25 locations?

26 Q Yes.

27 A Okay. If you want to go  
28 into more detail, there is a published paper in Canadian  
29 Journal, published by Pringle, Beaverlodge  
30 and they used my map for one species. This does not



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1  
2 indicate all the sites if you want to go in more  
3 detail.

4 So you could see that sites  
5 of the slender wheatgrass was collected on Mackenzie  
6 Valley, Yukon, northern B.C. and Alberta, not southern  
7 ones,  
8 /but you would get some indication and I would read  
9 you the locations that species --

10 WITNESS BOUCKHOUT: A You  
11 must understand, Mr. Carter, that some of this  
12 information might be priority information. Dr. Vaartnou  
13 will give you general locations, perhaps not the  
14 exact site locations.

15 Q Well, we'll see what  
16 he answers to this question.

17 A Okay. Site locations, I  
18 plan to use ecotypes collected from Inuvik, Agrostis  
19 scabra, Inuvik area, Festuca rubra, Poa glauca, Poa  
20 pratensis and Festuca, ecotype number 76. There is  
21 other Festuca rubra that I plan to use, but have  
22 collected from somewhere else.

23 Is this enough?

24 Q Enough?

25 A For your information.

26 Q All right, perhaps we  
27 can go at it a different way. How did you go about  
28 collecting the different --

29 A Collecting. Yes, usually  
30 the people don't know what they are collecting. They  
collect, just grab everything that is acceptable or that



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1  
2 is available. To me, that is not the way to go about  
3 collecting. To me, I have certain things in mind  
4 when I go out collecting. And I know if it's a cross-  
5 pollinated species, if it's self-pollinated species,  
6 if it's apomictic . And this is one first criteria  
7 that I am going to use to base my collection.

8 Then, I'm going to think  
9 of the purpose, what's the purpose of going to use  
10 that seed? If I need that seed for forage crop, or  
11 lawn purpose, I am looking at the activities of the  
12 plant.

13 Q How did you actually go  
14 out in the field and collect it?



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Taylor, Reeves  
Cross-Exam by Carter

1  
2 A Oh, I use walking, I  
3 use car, I use boat.

4 Q You've got what, about  
5 26 different ecotypes in the Northwest Territories?

6 A Oh no, that's small.

7 Q How many?

8 A Oh, I have about, if I  
9 could roughly, I collected every 50 miles in Mackenzie  
10 Delta.

11 Q All right, let's deal  
12 with that.

13 A There was 20 there, and  
14 average I collected 10 to 24 ecotypes in each location.

15 Q So you say you went what,  
16 by boat, and then every 50 miles you stopped?

17 A We stopped and we went  
18 to the ground and we spent the night, we collected  
19 every grasses available at that location.  
20 Then we go onto another location.

21 Q I see, and these were  
22 within walking distance of your boat on the river.

23 A Oh, we spent overnight  
24 there and we didn't get lost, we had Indian guide to  
25 guide us.

26 WITNESS BOUCKHOUT: I believe,  
27 by the way, Mr. Carter, Dr. Vaartnou meant every 50  
28 miles in the Mackenzie Valley, not the Mackenzie Delta.

29 WITNESS VAARTNOU: Yes,  
30 Mackenzie -- oh, sorry, it's Mackenzie Valley.



Bouckhout, Drew, Claridge  
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Taylor, Reeves  
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Q I am advised, sir, that the Mackenzie River may have transported seeds of species from the south, that might even be considered weeds, and they've been deposited along the Mackenzie Valley and that these are not typical of what you might find in the more upland areas away from the river valley.

A No, that's right, but when you consider that the plants in the Mackenzie Valley mainly came from the north.

Q Well, is there any truth to the suggestion I put to you?

A We believe that original migration came from Yukon area where it was unglaciated.

Q Yes.

A And I guess there is some weeds everywhere with people, but the basic material came from the north and if we look at Houlstan's circumpolar maps you could see that most of the species, the circumpolar species have been coming from north or some other areas, not from south.

Q All right, so you went along in your boat down the river and collected these species at 50-mile intervals, and my question is, would those ecotypes that you collected necessarily survive in more upland areas away from the river where you have a different climate, different soils, and those sort of considerations?

A You know, if by meaning "ecotypes" you mean talking right now on river areas.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Carter

1  
2 Ecotypes meaning is certain micro-environment  
3 conditions and quite a few of my ecotypes is not  
4 river valley ecotypes but upland ecotypes.

5 Q Yes.

6 A If I go there and collect  
7 them there, some kinds of gravel pit  
8 or something like that and that is definitely an upland area  
9 so it is collected on some mountain slopes. This is  
10 not river valley ecotype, it's an ecotype for that  
11 conditions.

12 Q But in any case --

13 A Is it in fertile soil or  
14 is it in such completely no fertility at all and  
15 this ecotype according to that, and that is the  
16 information when you collect, go out and that's the  
17 information you have to bring in from the field to  
18 know your ecotype. If you don't collect that information  
19 you don't know what ecotype you've got.

20 Q Right. In any case, though,  
21 they were collected within walking distance of the  
22 river.

23 A Yes, some 15-20 miles.

24 Q You mean to say you walked  
25 15 miles from the river?

26 A Yes, we camped overnight  
27 sometimes.

28 Q Where was that that you  
29 walked 15 miles from the river?

30 A I can't say exactly, but



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Taylor, Reeves  
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1  
2 I could say a location where we were.

3 Q You can't recall that?

4 A No, it's too long for  
5 me to recall exactly.

6 Q So this was when, in  
7 1967?

8 A '67, yes.

9 Q I see.

10 A I was promised a nice  
11 bear skin, I paid it but I haven't got it yet.

12 Q Was that on your 15-mile  
13 hike?

14 A Yes, it was far up the  
15 river and we weren't able to get it there and that's  
16 the reason it was promised, I'm still waiting. I expect  
17 to get it sooner or later.

18 Q Now, getting back to  
19 the two things that you're optimistic on but have to  
20 prove to be true. These seeds that you collected on  
21 your trip, you have to be able to plant them somewhere  
22 where, north of 55, you say?

23 A Did I mention I collected  
24 seeds? Where you get that from?

25 Q What did you collect, sir?

26 A Plants.

27 Q All right, so you take the  
28 plants and you take them and plant them somewhere north  
29 of 55?

30 A Yes, I plant them in



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Taylor, Reeves  
CrossExam by Carter

1  
2 the Beaverlodge Research Centre.

3 Q All right, and then  
4 you collected the seed from those plants?

5 A Yes, some later on.  
6 But first I had to evaluate them uniformly, if there was  
7 any difference or not.

8 Q Yes.

9 A That's the normal way to  
10 handle it.

11 Q So now you've got the  
12 seed from the ones you've selected and you've taken  
13 them back and planted them at Beaverlodge.

14 A Yes, some seed and some  
15 still original vegetative propagative material that  
16 I carry on when I am afraid that I will lose the  
17 original material then I have to carry it on vegetat-  
18 ively because otherwise I'd lose the identity of the  
19 plants.

20 Q This is still at  
21 Beaverlodge, is it?

22 A No, because when I left  
23 it it was turned over, the garden was turned over  
24 to Mr. Pringle. They tried to hire somebody to re-  
25 place and carry on that work and it means the salary  
26 was a little bit too low to locate a man who is  
27 able to handle it, and they're still looking, and it  
28 was carried out first for five years, and every year  
29 it's diminishing because no way to maintain it, and  
30 they plowed in last one last year.. I'm sorry but



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1  
2 they collected seed of all of those but there wasn't  
3 a real ecologist to take notes and seed is there but  
4 who knows what it is?

5 Q But you took some seed  
6 from Beaverlodge, did you?

7 A Some, yes.

8 Q I may be using the wrong  
9 term, but you say you have some plant matter as well?

10 A Yes.

11 Q But that's not at  
12 Beaverlodge any more.

13 A No.

14 Q That's where, Edmonton?

15 A That's my secret.

16 Q Well, it's important,  
17 is it not, where you plant it in the south?

18 A Pardon? Yes, this is  
19 in four different locations of Alberta.

20 Q And all north of 55?

21 A One is 54, the rest are  
22 not.

23 Q And where is the one at  
24 54?

25 MR. LUTES: I think the witness  
26 has declined to answer that.

27 A It's in Pearce, in the  
28 most severe conditions in Alberta and with the shortest  
29 growing season, and it's close to Pearce. Do you know  
30 where it is?



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Taylor, Reeves  
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MR. CARTER: Yes.

A O.K., good.

Q You took 55, I take it,  
because that's roughly around Beaverlodge?

A No, no, it's nothing to  
do with that.

Q What does it have to do  
with then?

A Oh, yesterday I mentioned  
that sclerotinia borialis, northern snow mould, that's  
the line, north of that one the plants you suspect they  
could be affected by that disease and that's the one  
that's the most important in northern areas, and that's  
the line for me and that's the reason I want my plants  
to be affected by that disease.

Q So south of 55 you don't  
have the problem with snow mould?

A Not so severe  
and very seldom, within once every five years in  
Edmonton area get some light damage. There are other snow  
moulds,  
/I guess you are aware that there is approximately five  
different snow moulds in Alberta affecting the perennial  
plants?

Q No, I wasn't aware of  
that, sir.

A O.K.

Q But Beaverlodge is about  
55.



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A Yes approximately, yes.

And every five, six years there's very severe attack of  
sclerotinia borialis there that could kill most  
susceptible plants, perennials.

Q All right. Now, again  
getting back to the two things that have to happen.  
You take plants and replant them north of 54  
someplace and produce seed from them or seed from the  
seed that you've replanted that you've produced from  
these plants. Is that correct?

A Yes.

Q And you have to produce  
enough to be able to carry on your revegetation program.

A Yes.

Q That's the first thing.  
The second is then you have to take the seed that  
you've produced and use it in your re-vegetation program  
in the north.

A Yes.

Q And they have to succeed,  
these seeds have to germinate and survive.

A That's correct.



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Q As yet that has not been  
proven?

A Not when you can't plant  
one seed twice. If it is once planted it has to grow  
that way or else it will be killed. So anytime when  
you plant it you can't take it back anymore.

Q All right. Have you taken  
seed that you produced in Alberta and planted it at  
various locations in the north to see whether or not  
your ideas in fact are as sure that you consider they  
really are.

A Yes, the first seed was harvested  
last year or really 1973 in High Level and it was planted  
this year in the Pine Point area and we know that it  
germinates, but we don't know how long it stands but  
we expect that if it is selected for that purpose on  
certain environmental conditions we can expect the best  
results from that material. But we are comparing it  
with the other materials that are on the market too.

Q It's germinated you say?

A Oh, yes.

Q But it has not had a winter  
yet?

A Not yet.

Q And Pine Point is a long  
way from Inuvik, for example?

A Yes. I know that.

Q So in that sense you haven't



Bouckhout, Drew, Claridge,  
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Cross-Exam by Carter

1  
2  
3 really tested it in the Inuvik or more northern regions?

4 A No, but we plan to do it  
5 starting in the spring, to establish that site.

6 Q All right, but they haven't  
7 done that yet?

8 A No.

9 Q I wonder, sir-- Well, first  
10 of all in your list of reports that you referred to,  
11 you mentioned reports of Dr. Mitchell of the University  
12 of Alaska?

13 A Yes.

14 Q You're aware of his work?

15 A Yes. He is a special  
16 friend. We spent quite a few weeks together in 1978  
17 in Alaska with him.

18 Q 1968.

19 A 1968, sorry.

20 Q I wonder if I could read  
21 a passage from one of his reports and then ask you  
22 a question?

23 A Sure.

24 Q This is a progress report  
25 for 1973 from the Prudhoe Bay and Palmer Research  
26 Center by Dr. Mitchell and J. D. MacHendrick. The page  
27 that I would like to refer you to is page 8 and if I  
28 can read the passage that begins at the middle of the  
29 page, "Sufficient seed supplies of only a few Arctic  
30 collections were available for planting in 1972."



Bouckhout, Drew, Claridge,  
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"This illustrates a problem in dealing with Arctic materials. Seed production in the Arctic, by many plants that appear desirable for re-vegetation purposes is very poor. Furthermore these plants also may be poor seed producers when moved to boreal locations under what appear to be better growing conditions. They may even have problems growing vegetatively. Some show definite signs of physical stress early in the growing season or suffer from diseases that they may not encounter in the Arctic. Plus a large number of plants, involving different species must be screened for potential candidates. Progress has been made towards selecting better seed producers among red fescue and bluegrass collections from the Arctic. Of course, selections made on the basis of superior performance at a boreal site may not bare up under Arctic conditions. Thus, materials derived from these selections must be tested in the Arctic before final decisions can be made".

A That is exactly what I said and it is exactly correct, that if I read it back to you, "progress had been made towards selecting", and that is exactly what I have been able to make too. I have been working for the last ten years with that point of view and I will tell you I have some progress. And if you read the Pringle and Ellis paper, you



Bouckhout, Drew, Claridge,  
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Cross-Exam by Carter

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3 will know that it is approximately 25% what you can  
4 expect to see production from the northern ecotypes  
5 in southern areas. So I don't expect a full amount  
6 of seed produced in the south. You expect less but  
7 you can still expect some seed and sometimes instead  
8 of getting the seed second year, you have to wait  
9 an extra year because some, I hope you know, because  
10 some flowerization occurs in the previous year and  
11 if the plant is not strong enough, they cannot pro-  
12 duce the parts that produce the flowering heads.

13 So, you have to expect to  
14 wait one more year to be able to evaluate the seed  
15 production of that special ecotype  
16 or species.

17 Q These are problems that, and  
18 Dr. Mitchell mentioned this, that you encounter when  
19 you take the seed to the more southern regions, or  
20 the plant and try to produce ?

21 A Oh, yes.

22 Q He also points out though  
23 that in addition you have to take the seed you  
24 produce back to the Arctic and test it there.

25 A Exactly what we are trying  
26 to do.

27 Q But haven't done yet?

28 A No.

29 Q Now, supposing that when  
30 you do, your results aren't as good as you expect them



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Carter

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2  
3 to be. Have you an alternative?

4 A I outlined it yesterday.  
5 The seed was from the Arctic area. It was secondary.  
6 I expect to use a vegetative local species which was  
7 growing right there in that site there to use that for  
8 vegetative propogation as a basic ground cover for  
9 inducement area.

10 Q This is the process of  
11 shredding it up?

12 A Shredding, yes.

13 Q So that's your aternative?

14 A That's right.

15 Q All right. Now, dealing  
16 with that for a moment. You say that it has been  
17 used in golf courses?

18 A Yes, I have used it myself.  
19 I built three of them.

20 Q Did you have watering  
21 facilities there?

22 A Yes.

23 Q But you wouldn't have it  
24 along the pipeline right-of-way?

25 A Yes, but I think you know  
26 in some of that native frost and I am doing that test  
27 right now. You don't need any watering facilities to  
28 get the stems rooted, or mainly what I think that the  
29 shredded material are going to spread out the plant  
30 itself, most of them I have cut some roots already and



Bouckhout, Drew, Claridge,  
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Cross-Exam by Carter

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3 in Arctic conditions I could visualize that if they  
4 are compacted with soil, pressed into the soil, they  
5 are able to establish it and I guess that some of  
6 Arctic Gas indicates the same things, that if they  
7 planted cotton grass it was able to establish  
8 itself again and start growing. Unless it was turned  
9 over, the roots were lifted so high up and they are  
10 drying out.

11 Q Drying out is a big  
12 problem isn't it?

13 A Yes, that's correct.

14 Q And it is more of a  
15 problem since you have shredded this all up?

16 A Not necessarily.

17 Q Not necessarily?

18 A Not necessarily. If you  
19 press the shredded material into the existing surface  
20 it is not anymore a problem. Because in Arctic  
21 conditions, the first layer is usually quite moist.

22 Q Yes.

23 A And if you get high up,  
24 then it dries up, specifically if it is peat-type  
25 material. I prefer peat. I guess I visualize that  
26 there is forty different types of peat and they would  
27 be different but basically the same.

28 Q Now, you say you visualize  
29 what will happen?

30 A Yes.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
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tests on this?

Q But you haven't done any

A No. That is planned for start  
this winter.

Q And this is what you call  
your alternative?

A No, this is not an  
alternative. This is basic way to try to re-vegetate  
over there and seed is alternative.

Q Well, what if this doesn't  
work?

A I don't have right now any  
idea then. If that same material doesn't grow there  
what is the alternative? I guess we'll have to use  
artificial turf then.

Q I see. Now, Dr. Mitchell  
refers to the need to test these native grasses back  
in the Arctic. Are you aware of the work that he has  
done in this respect?

A Yes, I have read it.

Q And I am advised that he  
has tested over a hundred species and varieties and  
half of these are native and he has found only four  
or five that have any promise for re-vegetation.

A But he didn't find one  
introduced a promise. He found four or five native  
ones but not very many introduced ones with any promise  
to them.



Bouckhout, Drew, Claridge,  
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Cross-Exam by Carter

Q I see. Would you classify  
Arctared creeping red fescue and Nugget Kentucky  
bluegrass as introduced?

A Yes. Nugget Kentucky  
blue is completely because if I am correct that it  
is not known exactly where the original material came  
but it was introduced as a lawn grass and then selected  
in Alaska.

Q Yes. It was found in  
Alaska?

A Yes. But it was according  
to Collier and other fellows there, this was  
introduced and nobody does know exactly the reason  
that it is. The red fescue, it is possible  
that it is local material. That is possible to  
introduce also but definitely not Kentucky bluegrass.  
According to information to me it is not native in  
Alaska. It is selected in Alaska for the purpose of  
lawn and Nugget Kentucky bluegrass is one of the lowest  
growing Kentucky bluegrasses.

Q So they would come at least  
within the classification of a naturalized land-raise?

A That's correct.

Q Do you propose to use them?

A Not the Kentucky bluegrass.  
Arctared, possible, but not Nugget. It is so low.  
Nugget Kentucky bluegrass is one of the lowest bluegrass  
established and when I did the research in 1966 to 1968



Bouckhout, Drew, Claridge,  
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3 at Beaverlodge, that was one of the most susceptible  
4 bluegrasses together with other bluegrasses in the  
5 Beaverlodge area, against the scherotinia borealis  
6 and a paper is established on that  
7 also.

8 Q But you haven't tested  
9 these species in the Arctic?

10 A What species do you mean?

11 Q Nugget Kentucky.

12 A Do you mean the varieties  
13 of Nugget?

14 Q Yes.

15 A No, I have tested them and  
16 I know that it does not stand in Beaverlodge. Oh,  
17 yes you could expect if the weather is good, you could  
18 expect to stay in a few, yes. But if the severe  
19 conditions occur on the snow moulds you would loose  
20 it one or within five years. And I think some of the  
21 other research carried out by your company indicate the  
22 same and Dr. Mitchells report is the same.  
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Bouckhout, Drew, Claridge  
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Q The snow mould that  
you've done a lot of work on is something that doesn't  
occur every year but you can expect that it's going  
to occur and have a very detrimental effect  
in at least some years.

A It occurs every year, but  
its severity depends on the weather conditions fall  
before and spring. It would be affecting  
the plants in the fall, and it would be cold resistant  
and stays alive under the snow cover, and winter  
conditions are right in the spring then it does the  
damage.

Q Now, as you've stated,  
you've tested some of these at Beaverlodge, but as yet  
no further north than Pine Point, but do you have any  
plans to do so?

A All my test sites would  
be evaluated twice a year, first in the spring to evaluate  
the winter damage, winter damage done by diseases, not  
only that disease but other ones, and cold or desiccation.  
This evaluation in every spring would be done and  
the second evaluation would be done before the plants  
get dormant or such time in the fall or late summer,  
to evaluate the growth and how they are spreading out and  
how they survive. Their higher competitive ability should  
be evaluated in the fall and disease resistance, cold  
resistance, hardiness, should be evaluated every spring,  
and the plans are to do it within ten years, and we  
plan to have a first report within three years.



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Q But I take it you're

going to seed 200 acres next spring, 1976.

A For seed production.

Q And then 200 acres the  
year after.

A I would like, yes.

Q Where will that be, sir?

A Exact location I could  
tell you, but can't tell right now but it would be  
High Level area, Beaverlodge, close to Edson, and one  
site north-east of Edmonton maybe 150 miles north-  
east, and all would be selected where in my knowledge  
is the very severe conditions on the disease point of  
view exists.

Q And this is something  
you're doing yourself, is it?

A No, I can't do all the  
work myself. I expect I could hire somebody to do  
the work for me.

Q I see. You're contracting  
it out to farmers in those areas?

A I get farmers working on  
contract for me.

Q I see. How do they  
seed it?

A Depends how much seed is  
available what methods can be used.  
Some would be hand-planted; some would be seeded by  
hand, some would be -- I mean using fingers; some would



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seeded by using hand machines, and some would be

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seeded by using Brillian seeder type machine specially

4

adopted so that the row width can be regulated accord-

5

ing to the demand of that species.

6

Q Now you're going to seed

7

200 acres next summer? Next spring?

8

A Planting I

9

expect next spring.

10

Q But you've got no real

11

plans on say 50 acres here will be done in a certain

12

way, and 50 acres there?

13

A No, this depends on the

14

species and it depends on how much material I get.

15

Q You don't have those

16

plans yet?

17

A No. In my mind, yes,

18

but not on the paper.

19

Q I see. So would they be

20

divided up into plots of a certain size? How would

21

you keep all of these varieties or ecotypes separate?

22

A My basic approach would

23

be I would like to use each ecotype in two locations,

24

because if something goes wrong in one location, I have

25

still other location, I expect to have other location

26

available. If there is some cross-pollinated species,

27

I cannot plant two ecotypes in the same field, so I

28

have to use them in different locations. If it's self-

29

pollinated or apomictic variety

30

or ecotype I could plant two or three ecotypes in the



Bouckhout, Drew, Claridge  
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Taylor, Reeves  
Cross-Exam by Carter

1  
2 same field and that again depends what the feature  
3 is, I could use it accordingly. The basic rule is  
4 that each one would be planted in two locations to  
5 guarantee seed, and our plan is to produce twice, at  
6 least twice as much seed as we expect to need, and  
7 that could guarantee us at least sufficient amount  
8 for what's needed.

9 Q Mr. Bayly got into a  
10 discussion with you on how much you could produce,  
11 and I didn't necessarily follow it all. I'm wondering  
12 if I could try it in a different way? We heard evidence  
13 that the Arctic Gas proposal would take up about 40  
14 square miles of land in the Northwest Territories and  
15 the Yukon. Now, bearing in mind that Foothills do not  
16 go into the Yukon but that they have a considerable  
17 number of miles extra of right-of-way because of their  
18 laterals to Pine Point and Yellowknife, and also bear-  
19 ing in mind, of course, that you're not going to reseed  
20 the whole right-of-way, could I for the sake of argument  
21 take half of that and say 20 square miles?

22 A My calculation is  
23 approximately 7-8,000 acres, I don't know in square  
24 miles because I am not very good at mathematics.

25 Q So that would be over  
26 10 at least.

27 A Pardon?

28 Q Over 10 square miles.

29 A I am not good in mathe-  
30 matics. I use acres.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Carter

1  
2 Q Well, how many acres in  
3 a square mile?

4 A 640 or something like  
5 that.

6 WITNESS BOUCKHOUT: I think  
7 your assumption is generally about correct, Mr. Carter.

8 Q So if your specifications  
9 call for seeding of, if I can take an average, of  
10 around 25 pounds per acre?

11 WITNESS VAARTNOU:

A Yes, average.

12 Q Now, your plans call for  
13 200 acres to be seeded in '76, 200 the next year and  
14 200 the next year.

15 A Yes.

16 Q Correct?

17 A That's correct.

18 Q Roughly 600 acres and  
19 if we related that equivalent to a square mile it  
20 would be easier to work with. Say you're going to seed  
21 640, all right?

22 A O.K.

23 Q All right?

24 A Yes.

25 Q You're going to seed 640  
26 acres.

27 A For seed purpose.

28 Q Right. In other words  
29 you're going to seed a square mile in those three years.

30 A Oh yes, you could figure  
that.



Bouckhout, Drew, Claridge  
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Q All right, so if you were only going to reseed in the north another square mile, you'd have to get 25 pounds per acre.

A Yes.

Q But you're going to seed over ten times that much, over ten square miles. Right?

A Yes.

Q So you're going to have to get over 250 pounds per acre.

A Yes.

Q Do you feel confident that you can reach that goal?

A I guess you completely forgot one aspect, that you don't harvest seed one year, you harvest seed four years.

Q Well, I don't think so, sir, because you're only doing 200 each year, I am totalling them up.

A You keep that 200, you don't cut the 200 away next year, you produce twice as much next year as first year.

Q That's right.

A And you would harvest that seed /at least five years in a row.

Q But --

A So you get how much is total then?

Q -- I'm talking --

A 600 acres planted, it would harvest five years in a row.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Carter

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Q No, I'm saying to you  
and relying on your evidence that you're only going  
to plant 200 acres.

A I plant it, I can never  
say if I rip it up again next year.

Q No.

A So I keep it at least  
five years and maybe ten years, depending on the  
species, depends how long they produce seed.

Q All right.

A The total acres would  
be planted 600. The production would be every year  
600 for five years in a row.

Q All right, well let's  
refer to your evidence where you dealt with this.

WITNESS BOUCKHOUT: Excuse me,  
Mr. Carter, just a point of clarification here. If you  
want to plant 200 acres the first year --

MR. CARTER: Yes.

A An extra 200 acres the  
second year and an extra 200 in addition the third year.

Q Well, my question is, is  
there an extra 200?

A Yes, it is.

WITNESS VAARTNOU: It is.

Q So on page 12 where you  
refer to this contract seed production, you say:

"200 acres to be planted in 1976,"  
it should be 400 acres to be planted in 1976.



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawren ce  
Taylor, Reeves  
Cross-Exam by Carter

1  
2 A No, you don't read that.  
3 You plant extra 200 in '77.

4 Q O.K., I understand.  
5 Do you get seed the first year?

6 A No.

7 Q How long does it take  
8 to get seed?

9 A I expect some would  
10 produce second year, and some maybe take one extra  
11 year.

12 Q I see.

13 A But most of them would  
14 produce seed second year.

15 Q How would you plan to  
16 harvest that?

17 A Right now I order special  
18 machine from Germany, and special gleaning machine  
19 from Oregon State.

20 Q Is it anything like a  
21 combine?

22 A Yes, it's special combine  
23 designed for that purpose. There is another combine  
24 available from Oregon, but we expect to buy it when  
25 it's needed. The machine from Germany takes at least  
26 six months and so we already put order in,

27 Q Now, you've got 600 acres  
28 that are planted with 26 different types of seeds --  
29 I'm not sure that I know the right word -- but you've  
30 got 26 you want to produce seed for to use in the



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Carter

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Arctic, is that correct?

A In Arctic, you mean in  
the valley, not in Arctic.

Q All right, in the valley.

A Yes.

Q And further north you've  
got a pipeline running all the way up to the tundra  
area.

A Oh yes, Arctic, I would  
call it Arctic.

Q So now with this combine  
you're going to have to do, if you're having the same  
type of seed in two different places, 50 different  
plots, is that correct?

A That's correct.

Q And do they roughly set  
seed at about the same time?

A No.

Q How much time would you  
have to work with?

A Two months. First one  
might be ready end of June and the last one might be in  
the middle of August or the end of August.

Q So you're confident  
that in view of all that, that you can produce enough  
native seed to reseed all of the areas that will be  
required for the Foothills Pipe Line?

A Yes, I'm confident.

Q All right, but if you're



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Carter  
Cross-Exam by Marshall

1  
2 unable to do so, you don't have an alternate plan,  
3 you've referred to shredding but that's part of your  
4 initial plan.

5 A Yes.

6 MR. CARTER: I have no further  
7 questions, sir.

8  
9 CROSS-EXAMINATION BY MR. MARSHALL:

10 Q Firstly, Dr. Reeves,  
11 could you tell me what the extent of the archaeological  
12 work was that you did for Foothills?

13 WITNESS REEVES: As I said  
14 in my evidence, it's based on a search of published  
15 sources for known site locations and examination of  
16 air photography to evaluate potential sensitive areas.

17 Q Have you done any ground  
18 reconnaissance work for Foothills?

19 A No, I have not.

20 Q I understand, Dr. Reeves,  
21 that you've also been doing some work for Canadian  
22 Arctic Gas pertaining to archaeological matters.

23 A That is correct.

24 Q Could you just run through  
25 briefly what that's involved?

26 A This involved ground  
27 reconnaissance of the proposed section on the transmission  
28 system, the 2-C between Caroline, Alberta and Crow's Nest,  
29 B.C.

30 Q When did you do that, sir?







Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall

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2 A The field studies were  
3 completed three weeks ago.

4 Q Well, sir, with respect  
5 to archaeological reconnaissance and salvage work  
6 relating to a major pipeline project, do I understand  
7 correctly that really under the proposals of either  
8 of the pipeline companies -- you have some familiarity  
9 with both -- there would be an opportunity for an  
10 archaeological reconnaissance prior to the commencement  
11 of any construction activities, such as the reconnais-  
12 sance you mentioned that you did for Canadian Arctic  
13 Gas this summer.

14 A That refers to south of  
15 60; I think north of 60 the statements in the environ-  
16 mental -- I don't have the exact sections here -- sugg-  
17 est that there would be some structuring at that time  
18 to the field reconnaissance for Canadian Arctic Gas.

19 Q There would be an  
20 opportunity to examine the proposed route, say perhaps  
21 even using aerial photographs, so as to enable you  
22 to predict many of the likely sites that would be  
23 of archaeological value or interest.

24 MR. SCOTT: Mr. Commissioner,  
25 before the witness answers the question, he's identified  
26 himself as having done certain archaeological work for  
27 Arctic Gas to the south of the 60th Parallel. I take  
28 it that he is not the Arctic Gas expert who has done  
29 work to the north in the Territories, who is Dr. Mil-  
30 ler. I presume that Dr. Miller will give evidence on



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall

1  
2 the Arctic Gas proposals, their archaeological pro-  
3 posals if indeed he's going to be called at all, and  
4 an effort will not be made to get Arctic Gas' position  
5 on archaeological matters in the Territory from a  
6 witness who has not done any work for them in the  
7 Territory.

8 MR. LUTES: This must be an  
9 example of Mr. Scott acting for Foothills, but I  
10 didn't understand it to be related to Arctic Gas.

11 MR. SCOTT: Well, I didn't  
12 raise the matter, I must say frankly, because I felt  
13 obliged to on the Foothills behalf. I am simply con-  
14 cerned that the -- in Phase 3 in the Phase 3 panel  
15 there is a statement about archaeological matters on  
16 behalf of Arctic Gas, and there will be cross-examination  
17 about that when we come to it. If Arctic Gas is  
18 going to call an expert, an archaeological expert on  
19 work or proposals for north of 60, that's fine; but  
20 it doesn't seem to me legitimate to obtain that  
21 evidence from a person they have employed to do work  
22 in other parts of the country, and thereby remove the  
23 necessity of calling archaeological evidence.

24 MR. MARSHALL: Mr. Scott, you  
25 haven't listened long enough.

26 MR. SCOTT: I'm sorry. That's  
27 always a risk.

28 MR. MARSHALL: It's not my  
29 intention to get into that. I want to deal with some  
30 more general matters that relate to archaeological



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall

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2 work relating to large pipeline development, and  
3 what I wanted to make clear was that Dr. Reeves has  
4 some background in this area, he's done work both  
5 for Foothills north of 60, and he's done work and  
6 he's identified the area for Arctic Gas south of  
7 Caroline. That's simply the point I wanted to  
8 establish.

9 MR. SCOTT: Mr. Commissioner,  
10 I undertake to listen. My only concern is that I  
11 understood Mr. Marshall was attempting to elicit  
12 Arctic Gas' position on archaeological matters.  
13 Now we're not interested in their position on archaeo-  
14 logical matters anywhere else, only in the Northwest  
15 Territories, and the Yukon.

16 MR. MARSHALL: I wasn't  
17 attempting to do that but I can't see what difference  
18 it would make if I did.

19 MR. SCOTT: All I'm saying is  
20 that in our respectful view it doesn't get you off  
21 the hook from calling archaeological evidence by  
22 people who you have retained to do it in the Northwest  
23 Territories. That was the only point, Mr. Commissioner,  
24 that I wanted to make. So I have no objection to the  
25 question if that's understood.

26 MR. MARSHALL: Thank you very  
27 much, Mr. Scott.

28 MR. SCOTT: You're welcome,  
29 Mr. Marshall.

30 MR. MARSHALL: I appreciate



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall.

1  
2 your concern.

3 Q Dr. Reeves, I take it  
4 from your evidence with respect to the work that you  
5 have done for Foothills and anticipate doing for  
6 Foothills that you would have an opportunity to  
7 examine the proposed right-of-way and determine which  
8 sites are likely to be of significant archaeological  
9 interest, and I believe you've indicated you have done  
10 some of this work already from aerial photographs.

11 A Locales from aerial  
12 photographs. The line check would involve examination  
13 of these particularly sensitive locales to determine  
14 if in fact there are sites there, and if there are  
15 sites there, if they are of any value.

16 Q Right. But the first  
17 step then is really an archaeologist has an opportunity  
18 to look at the proposed routing for a pipeline and  
19 form a judgment as to whether or not it would be  
20 near or run through any areas that an archaeologist  
21 might think was likely to be of interest. That's the  
22 first thing.

23 A That's correct.

24 Q So that's the first  
25 opportunity really that a project of this sort provides  
26 to you as an archaeologist.

27 A Yes.

28 Q I believe you then  
29 mentioned that it is anticipated that there would then  
30 be an opportunity to go to those sites that were



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall

1  
2 expected to be of significance and to make some  
3 investigations to determine whether in fact they were  
4 of interest or they were not?

5 A Yes, but this would be  
6 done before final design.

7 Q Right, and that would be  
8 done ahead of construction, as you mentioned. So  
9 that's another opportunity that there would be to  
10 investigate sites of possible archaeological interest?

11 A Yes.

12 Q Now I take it that further  
13 on, once the initial construction activity would get  
14 under way and some clearing would be done, there would  
15 be another opportunity to an archaeologist involved  
16 with such a pipeline project to examine perhaps in  
17 more detail sites that may have been disclosed as a  
18 result of the clearing activity that's taken place.

19 A That's correct.

20 Q So that would be another  
21 opportunity that would be presented to an archaeologist.

22 A Yes.

23 Q And as well there is  
24 mention of an archaeologist having an opportunity to  
25 examine the ditch, the ditch itself, and the side of  
26 the ditch, and also the spoil mound. I don't think  
27 anybody was suggesting that the archaeologist is  
28 going to be there throughout the period of excavation  
29 of the ditch, but during periods of time when ditching  
30 is to take place near areas that have some archaeological



Bouckhout, Drew, Claridge  
Davison, Vaartnou, Lawrence  
Taylor, Reeves  
Cross-Exam by Marshall

1  
2 interest, the archaeologist could be there and have  
3 an opportunity to make that sort of inspection.

4 A Yes.

5 Q Would it be fair to say  
6 then, sir, that while it is true that the ditching  
7 operation itself may cause some destruction of sites  
8 that have not been identified to the processes we've  
9 talked about, that overall the building of the  
10 pipeline with the involvement of archaeologists such  
11 as you've described provides really a series of  
12 opportunities to archaeologists to make finds.

13 A I would qualify by saying  
14 potential opportunities, yes, it does.

15 Q Indeed, having a ditch  
16 wall exposed through the Northwest Territories for  
17 a distance of some 800 miles is somewhat a unique  
18 opportunity to archaeologists, given that finds  
19 really are very often related to examination of  
20 areas that are disturbed, that is until there is some  
21 disturbance you can't really find anything.

22 A In many areas.

23 Q Would it be fair to say  
24 as well, sir, that archaeological programs related to  
25 pipeline construction of the type that you were talking  
26 about in your evidence in terms of the money that's  
27 spent on archaeological investigation are very signi-  
28 ficant relevant to what we in Canada have been doing  
29 historically relating to archaeological matters.  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 A North of 60 if you want  
4 to qualify the area.

5 Q North of 60?

6 A I think until very recently  
7 I would answer yes. In more recent years there has  
8 been a more significant increase in input from  
9 governmental agencies. In certain areas of the  
10 Territories in relationship to certain projects.

11 Q I believe some of that has  
12 been funded by industry that is interested in some of  
13 the proposed developments. Dr. Morlan, no not Dr.  
14 Morlan but one of the other archaeologists working for  
15 the museum of man has some of his research work funded  
16 in part by industry.

17 A That is correct and is also  
18 the case of Foothills, I might add. It's pure research  
19 being done this summer.

20 Q Mr. Bouckhout, I would  
21 like to ask you a couple of questions about Foothills  
22 borrow requirements because it wasn't quite clear to me  
23 how far along Foothills was in the identification of  
24 its requirements in the areas in which they might be  
25 met.

26 I had been under the impression  
27 that there really hadn't been a precise determination  
28 made of the requirements and I know you have given us  
29 a figure of 18,000,000 cubic yards. I believe you  
30 indicated that that wouldn't include any borrow that



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 would be required for backfill of the ditch and I  
4 believe you mentioned this well, that it wouldn't  
5 include anything that would be required for the laterals?

6 WITNESS BOUCKHOUT:

7 A Yes, that's correct. As  
8 I mentioned earlier that our people feel that it is  
9 very difficult, if not impossible at this time, to  
10 really accurately determine how much material you are  
11 going to need for replacement of ice-rich backfill over  
12 the ditch line and therefore I gather we have not, in  
13 fact, projected that.

14 Q Well, I think Mr. Bayly  
15 asked this about you as well. He wanted to know  
16 whether or not Foothills has determined what quality  
17 of materials would be required, say at a compressor  
18 station site, he was interested in finding out whether  
19 or not Foothills would take only the quality it needed  
20 or it would want to get first quality materials, perhaps  
21 in situations where they didn't need quite that quality.  
22 Do I understand correctly that your evidence was that  
23 sort of a determination hasn't yet been made?

24 A That's correct. It hasn't  
25 yet been made. My impression is that materials for  
26 these types of uses, such as padding for compressor station  
27 pads and so on, the type of material for these purposes,  
28 it is not necessarily high quality materials that are  
29 necessary. The high quality materials are really  
30 necessary for river weights and swamp weights and so on,  
the concrete aggregate.



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 Q And I gather that while  
4 Foothills hasn't really determined, with any degree  
5 of certainty, which borrow pits it would be using  
6 either as preferred or alternative sites?

7 A That's right. We have  
8 identified the materials that are there. We have  
9 simply selected from the various inventories available  
10 locations where materials are available. We haven't  
11 gone to the actual point of saying, we will use this  
12 and we will not use that, and we have done some  
13 assessments from the biological crew, further assessments  
14 including drilling are yet to be done. It is simply  
15 not on the stage, not on the critical path that should  
16 have been completed by this date.

17 Q Well, sir I thought I had  
18 gathered that correctly from your evidence and that's  
19 why I was somewhat surprised when you quoted, and I  
20 think you did so twice, pretty exact figures as to the  
21 percent of general fill materials and aggregate materials  
22 that you would take out of borrow sites. If I have the  
23 figures correctly, you said between seven to seventeen  
24 percent of the available general fill materials and  
25 between 0.6 and 0.8 percent of the aggregate materials.

26 A Yes, I think I quoted  
27 something in that range and it was based as I have said  
28 several times that the actual quantities which we have  
29 identified are subject to some change and the quotation  
30 of those particular numbers were dependent on those



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A Well, as I said the determination of these figures was based on the pits which we had recognized on our alignment sheets, on our spread sheets. Now these are the pits or the areas, the



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.

Cross-Exam by Marshall

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3 borrow areas which have been identified by the DIAND  
4 Inventory and by the D.P.W. people and the figures are  
5 based on our projection of needs from those pits, if  
6 in fact, we do use those pits, in comparison to what  
7 the various inventories have said could be available  
8 in those pits.

9 Now, it does not take into  
10 account any other sources which are along the line as  
11 well. Simply those which we have said are the potential  
12 actual sites.

13 Q Would those estimates that  
14 you gave, those percentages include borrow materials  
15 required for backfill?

16 A No, they don't.

17 Q And they don't include  
18 the laterals?

19 A That's right. The figures  
20 are strictly based on the mainline and I do agree,  
21 they are general figures.

22 Q Given that you separated  
23 aggregate materials from general fill materials, I take  
24 it that Foothills has made an assessment of how much  
25 each type of material it does require and where.

26 A I believe we have done a  
27 general assessment. That's right.

28 Q Well, it must have been  
29 specific enough to enable you to determine that in no  
30 case are you going to take more than 17% of the general



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 fill material from any of the borrow sites?

4 A Yes, this is true beyond  
5 the fact that we haven't projected to the replacement  
6 of ice-rich backfill etc.

7 Q Well, if such a identification  
8 has been made then sir, I wonder if it might be made  
9 available?

10 A I suppose it could be made  
11 available. I will certainly check with our engineering  
12 department and see if they can do so.

13 Q I would appreciate that Mr.  
14 Bouckhout.

15 MR. LUTES: Mr. Marshall are  
16 you asking for the calculations by which we calculated  
17 this precise figure of 7 to 17%?

18 MR. MARSHALL:  
19 Well I am really interested  
20 in an identification of those borrow sources that  
21 Foothills is intending to use to take the aggregate  
22 material and also the general fill material.

23 MR. LUTES: I didn't understand  
24 the question to be asked of the sources.

25 Is that what the  
26 witness understood?

27 A No, I would like you to  
28 put that question to me again Mr. Marshall. I am not  
29 sure exactly what your looking for. I never intended  
30 when I produced these figures to indicate that they  
were anywhere near exact. These are fairly ballpark



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 figures and all I am using them for is illustrative  
4 figures to try and give some indication as to what we  
5 are dealing with here.

6 MR. LUTES: Maybe we could be  
7 a little more precise. I am not sure what it is you  
8 want us to produce, Mr. Marshall.

9 MR. MARSHALL: I think it  
10 gets back to this. We have been given figures that  
11 the requirements of Foothills can be met by taking from  
12 between seven and seventeen percent of the general fill  
13 materials from the borrow sites that Foothills intends  
14 to use and the percentage of aggregate, we are not quite  
15 clear on the figures, I had thought it was from 0.6  
16 percent to 0.8 percent but Mr. Bouckhout thinks it might  
17 have been a wider range than that.

18 Now it seems to me that if  
19 the calculations have become that precise, Foothills  
20 must have identified then the particular borrow sources  
21 that it intends to draw from and I would like to know  
22 that. I would like to know which those, what those  
23 sources are.

24 Secondly, the Foothills must  
25 have determined how much of the two grades of material  
26 Mr. Bouckhout was describing, Foothills intends to take  
27 from each of those sources and I would be interested in  
28 knowing that.

29 WITNESS BOUCKHOUT: Mr.  
30 Marshall, the figures I produced were simply to indicate



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves.  
Cross-Exam by Marshall

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3 in general terms, that we are not going to take a vast  
4 percentage of the material that was potentially avail-  
5 able. I have very generally run the figures. Ob-  
6 viously when you do a percentage, you come up with a  
7 number. Now perhaps I have erred in rounding it off  
8 a bit. In fact, in concrete aggregate, the  
9 numbers are pretty precise, but I don't present that  
10 to indicate that we do in fact have that precision  
11 available right now.

12 I could for instance, round  
13 the concrete aggregate off to say one to five percent  
14 and I could round off our 18,000,000 to 20,000,000.

15 Q Well, let's see if I  
16 understand the import of what your saying. Taking your  
17 rounded off figure of one to five percent for aggregate,  
18 are you telling us that in no case is Foothills going  
19 to take more than five percent of the available aggregate  
20 from any of the borrow sources it has identified?  
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Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Marshall

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3 A No, definitely not. This  
4 was done in general areas. This is not one calculation  
5 for the entire line or per mile. In fact, the way we  
6 broke this down when we did the general calculation, I  
7 believe, was mileages 0 to about 138 or the tundra  
8 zone, the permafrost tundra zone, 138 to about 287,  
9 about Chick Lake which is you know very generally the  
10 remainder of the permafrost zone, the Canadian's  
11 permafrost zone. Chick Lake down to about Wrigley  
12 and from there, Wrigley down to the border.

13 Q So no determination has  
14 been made<sup>then</sup>/as to how much borrow would be taken from  
15 any site?

16 A Any particular site?

17 Q Any particular site.

18 A I don't really know  
19 precisely. I believe certainly our engineering  
20 department has looked at that and has a general proj-  
21 ection of what is to be taken from individual sites  
22 and if, in fact, those individual sites are to be used.  
23 Again, as I say, this is, we are not at the stage  
24 right now. We don't feel we should be at the stage  
25 right now whereby we have to actually designate that  
26 since we haven't drilled the individual sites as yet.

27 Q Well then, do I take it,  
28 Mr. Bouckhout, that what you are telling me is that  
29 within a large area or a segment of the line, Foothills  
30 won't be taking more than 5% of the aggregate that's  
generally available within that area?



Bouckhout, Drew, Claridge,  
Davison, Vaartnou, Lawrence,  
Taylor, Reeves  
Cross-Exam by Marshall

A I think in that general  
range. I'm just trying to give you a general concept  
of what we are talking about.

Q Well, you gave us a  
specific figure and that's what led to my questioning.  
I wanted to --

A Well, I can't really talk  
figures unless I give you the figures.

MR. LUTES: He gave you a range  
from 1 to 5% and nothing could be less specific.

THE COMMISSIONER: Nothing  
could be less specific, right.

MR. LUTES: He keeps referring  
to it as 7 to 17% as being precise. The witness keeps  
saying it is just a general ballpark --

MR. SCOTT: Well, surely the  
point, Mr. Commissioner, simply is this. If it's a  
general ballpark figure arrived at by Mr. Bouckhout  
upon which nobody is expected to rely, well then, that's  
fine. We know where we stand but if on the other hand,  
it is intended to be a genuine estimate of what they  
will take, then the question obviously is highly  
appropriate. Is it the former or is it the latter or  
is it unfair to ask, does Foothills want to consider it?

A It was intended to be a  
general ballpark figure to give us an indication, sort  
of to put it in words, to give us an indication of the  
relative terms or of the magnitude we are really talking  
about.



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It was never intended to  
be an exact figure to the nearest 5% or .1% or anything  
like that.

MR. MARSHALL:

Q Well, I think I understand  
what your position is now, Mr. Bouckhout. I appreciate  
that. Mr. Drew, in your evidence, you talk about a  
terrain sensitivity rating and as I understood your  
comments, you are indicating that this in your judgment  
somewhat of a significant difference between the  
work that you have done for Foothills and the work  
that Arctic Gas has had done?

WITNESS DREW: Yes, that  
is correct.

Q And you regard this as  
kind of a difference in the approach in this area with-  
in your discipline?

A A difference in approach  
and a difference in desired results, I think. We're  
not trying to just do entirely an engineering  
project, we are trying to do a complete project. At  
least, I am from terrain typing and environmental as  
well as an engineering project.

Q I don't know, sir, whether  
you were here when the geotechnical witnesses for  
Arctic Gas were asked some questions about terrain  
sensitivity ratings. It's quite a while back and I  
suppose all our memories are fairly foggy on this.

I think generally the  
position of the Northern Engineering people and Dr.



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2 Clark's group that they have given some thought to  
3 a terrain sensitivity rating and they found it for their  
4 purposes it doesn't appear to have any practical  
5 application or utility, that it's an interesting  
6 academic exercise if you like but they can't translate  
7 that into meaningful engineering terms.

8 Do you understand that  
9 or are you aware that there's generally that difference  
10 of opinion between yourself and the Northern Engineering  
11 people who are involved in this same area?

12 A I haven't attended -- I  
13 didn't attend the geotechnical sessions but I had the  
14 general impression that that was their attitude, that  
15 they didn't feel that it was important that they were  
16 aiming -- I don't think -- I couldn't find anywhere  
17 in their material where they really described terrain  
18 sensitivity or went into it and I get the impression  
19 they were interested in the feasibility for construc-  
20 tion which our geotechnical staff has taken care of.  
21 But I didn't get the impression they were interested  
22 in sensitivity of the terrain that would help them pick  
23 a route, if they had to go in for emergency repairs  
24 or for ancillary facilities if they were trying to  
25 give a general idea of the terrain sensitivity or a  
26 possible environmental impact for the whole corridor  
27 which is what I tried to do in ours and I'm not trying  
28 to make it practical from an engineering point of view  
29 by adding these numbers. I'm trying to contribute  
30 something to environmental impact point of view.



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Q Well, do I understand correctly, then you feel that the significance of the terrain sensitivity rating of the type you have developed is related to environmental matters rather than engineering?

A Yes, I brought that out in my direct evidence yesterday in the example with the talus slopes, I think.

Q I still have a little difficulty with this concept, sir. And I would appreciate if you could elaborate on it a bit for me by telling me a little bit about the term sensitivity. Sensitivity to what, sir?

A Sensitivity to a change from the natural state and the inability to revert to that natural state.

In other words, a sensitive terrain, say, you go over it with a vehicle, more sensitive is more apt to leave tracks on that terrain or the more apt those tracks are to turn into gulleys and so forth.

Q Well, when you look at it, sir, and have done so for Foothills in this project, what do you have in mind when you are trying to assess sensitivity and let me suggest a number of things that may well have very different consequences in so far as terrain is concerned, walking over some terrain, driving a pickup truck over some terrain in the summertime, driving the same pickup truck over that terrain in the



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2 winter when the ground is frozen, going over that  
3 vehicle with a rologon or soft track vehicle, going  
4 over it with a ditching machine, operating a chilled  
5 pipeline through it, and I suppose the list could go  
6 on but do you have any one of those activities  
7 specifically in mind when you are assessing and  
8 assigning a rating of sensitivity to a terrain?

9 A No. No one specific  
10 activity and of course, you mentioned going over in  
11 the winter, you'll see if you read a description of  
12 the terrain sensitivity in the preface to the alignment  
13 sheets, that these are summer sensitivities and I  
14 explained that in most cases, winter sensitivity is  
15 very low from a terrain point of view, sometimes  
16 not from a plant point of view. I have in mind a  
17 general sensitivity and if you have very sensitive  
18 terrain, it's going to be damaged by walking on. If  
19 you have less sensitive terrain, it's not going to  
20 be damaged unless you run non-carrying vehicle traffic  
21 on it and so forth.

22 Q I see. So your sensitivity  
23 rating then is meant to apply to the summer, specifi-  
24 cally and you have in mind say operations and main-  
25 tenance activities along the right-of-way?

26 A Yes, or any trespass.

27 Q Sir, I was wondering  
28 whether or not you were familiar with the report of  
29 Dr. Strang for the Canadian Forestry Service of  
30 Environment Canada prepared for the Environmental



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2 Social Program Northern Pipelines, published August,  
3 1973. It is entitled "Studies of Vegetation, Land  
4 Form and Permafrost in the Mackenzie Valley, Some  
5 Case Histories of Disturbance."

6 A Yes, I did go through that  
7 at one time.

8 Q The passage that was  
9 pointed out to me sir, is found on page 24 under  
10 section 8, conclusion, section 8.1, the title is  
11 "Inappropriateness of Terrain Sensitivity Rating". Sir  
12 I would like to read this paragraph into the record  
13 and then ask you if you could comment on it, if you  
14 would?

15 A All right.

16 Q The passage is as follows.  
17 "No general terrain sensitivity rating could be  
18 derived from these case histories, and it is  
19 doubtful if any system valid at more than  
20 a general level is possible. There are  
21 three reasons for this. Firstly, there are  
22 considerable point to point variations in  
23 micro-site, particularly slope aspect and  
24 sub-surface moisture, all of which produce  
25 different responses to any disturbance.  
26 Secondly, seasonal effects have an  
27 important bearing on response in three  
28 "states" or "conditions" can be recognized  
29 corresponding to the seasonal weather changes:  
30 (a) the frozen state in winter, the least



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2 vulnerable; (b) the thawing state in spring,  
3 the most vulnerable; and (c) the relatively  
4 dry state in summer, intermediate invulnera-  
5 bility between (a) and (b). Lastly, the  
6 kinds of disturbance possible are many and  
7 the differences in intensity almost  
8 infinite. All of these factors militate  
9 strongly against the production of a useful  
10 sensitivity rating."

11 That's the end of the  
12 quote. I should perhaps, before asking you to comment  
13 on it, sir, point out that as I understand it from  
14 looking at the report Dr. Strang inspected some 200  
15 disturbed sites in the Mackenzie Valley in 1972  
16 in an area between Fort Simpson, I believe and Inuvik.  
17 You are familiar with that, are you?

18 A I'm not familiar specifi-  
19 cally no, but I say sometime ago I did peruse that  
20 report.

21 Q Then, the statement that  
22 I read from the conclusion based on the results of his  
23 analysis of those various sites. I'll show you the  
24 passage, sir, so you can read it over and perhaps  
25 you could comment on it.

26 A Well, I think I could  
27 comment right at the moment on that that I have taken  
28 care, I think, of some of his objectives in that well  
29 first I have given a range of ratings for each terrain  
30 type realizing that in something like a hummocky



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2 moraine, the sensitivity in the hollows is much higher  
3 than on the knobs and so forth so I have given a  
4 range for that type.  
5

6 Secondly, as regards to  
7 the seasons, I have taken into consideration when  
8 things are very wet by spring thaw or exceptionally  
9 heavy rainfall in the summer, I put a little 'w' in  
10 there say a rating may be 2w3 means normally in the  
11 summer when thawed it's 2 but during the spring thaw  
12 or during a rainstorm when it's exceptionally wet, you  
13 have the higher rating and also I have indicated there  
14 that these terrain sensitivity ratings apply to the  
15 summer so I have taken care of the seasonal variation  
16 and the wet and dry variation and the variation within  
17 the units. I believe those are the three main points  
18 of his argument that he feels that terrain sensitivity  
19 ratings aren't useful. I feel that they are. I don't  
20 feel that you could take them as a Bible and the  
21 numbers exact but it gives you a general idea comparing  
22 one unit to another and selecting which unit you are  
23 going to try to trespass on if you have to trespass  
24 say for repairs or one thing or another.

25 I just indicate that  
26 perhaps Mr. Claridge would like to add something on  
27 this.  
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2 Q Perhaps he will, but I  
3 want to follow up on something that you were just  
4 saying, and that is you say that you've tried to take  
5 into account his objections to it, but don't your  
6 methods of taking these objections into account  
7 really make the rating a more general one, that is you  
8 give a range or you give variations or so on?

9 A That is correct, you have  
10 to.

11 Q So it makes it less concise.

12 A Well yes, I think I  
13 explained when you cross-examined me on the stand  
14 in August 21st or 22nd when we were here on the  
15 location panel, that in an area the size of this room  
16 you can have quite a variation and there's no way  
17 you could map something as big as this table or as  
18 much as the distance from you to me on a scale that  
19 we're mapping and give a separate rating to each  
20 little thing. You have to give a rating over a range  
21 of ratings over an area; and then for detailed work,  
22 geotechnical people and so forth do their drilling  
23 and other things for detailed work. They can get  
24 site specific information for very small areas. This  
25 is the general overview that's presented on the  
26 alignment sheets for initial planning.

27 Q Just on that point, and  
28 I'm not forgetting you, Mr. Claridge, I'm sure you  
29 won't forget the point you want to make, you were  
30 talking about an area say the size of this room and



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2 the need for a range within it, if that's so and there  
3 would be a range in the sensitivity rating for an  
4 area the size of this room, how is that of any use  
5 to an operations and maintenance crew going in to  
6 repair a pipeline?

7 WITNESS CLARIDGE: Excuse me,  
8 Mr. Marshall, I think you're dwelling in the area of  
9 site specific geotechnical engineering and as such I  
10 think Mr. Drew made it clear that his involvement  
11 is at a preliminary stage. His sensitivity system  
12 is an extension of terrain typing which Arctic Gas  
13 has made very similar use to, and I think Mr. Drew  
14 has simply extended them a little bit and made it  
15 clear that it was a location tool something with which  
16 to gain a preliminary assessment. At no time have  
17 Foothills indicated that they would go into a  
18 design procedure on the basis of terrain typing and  
19 I think that the distinction has been made in that  
20 Arctic Gas has used terrain typing.

21 Q Excuse me, Mr. Claridge,  
22 you're talking about something that is different from  
23 what Mr. Drew and I are talking about.

24 A No, I disagree because  
25 the items you brought up, and I agree entirely that  
26 sensitivity ratings cannot be used in application to  
27 specific items such as slope stability and drainage  
28 erosion, and I haven't heard Mr. Drew say anything  
29 to the contrary. They are engineering items within  
30 the geotechnical field and I don't see that there



1  
2 is a contradiction in anything that Mr. Drew said  
3 but I think you are trying to aim engineering questions  
4 at Mr. Drew that he's told you he's not involved with.

5 Q I think, as I was  
6 trying to say, you're concerned about something that  
7 I hadn't realized that I was discussing with Mr. Drew.  
8 Mr. Drew indicated that he felt it had use for environ-  
9 mental purposes and he agreed with me that operations  
10 and maintenance activities would be one of the areas  
11 of possible application, and I want to pursue that  
12 with him, Can you tell me, Mr. Drew, how an operations  
13 and maintenance crew would be able to make use of such  
14 a sensitivity rating, given your example of an area say  
15 the size of this room in which there was a variation  
16 in the sensitivity over such a small area.

17 WITNESS DREW: O.K., say you  
18 had an alignment sheet and if we're going to have  
19 to go in and make an emergency repair, we're going  
20 to have to trespass on this alignment sheet to a  
21 certain point that's on there, and there are going  
22 to be a number of terrain types mapped in different  
23 ways they could go. There are some of the terrain  
24 types that have almost a uniform rating, some are  
25 going to have very variable rating, some are going to  
26 have almost a uniformly high rating. Not all units  
27 vary in an area the size of this room, just some  
28 units do. So they can pick a route, if they have  
29 to do it very quickly just on the basis of the  
30 alignment sheets. They can pick a route through the



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2 units that have generally the lowest ratings, and if  
3 they have more time somebody can go on the ground  
4 and pick the final route that they're going to take,  
5 they will want to know whether they're going to start  
6 here or five miles down, so this would give them the  
7 place to start to get more specific. In other words,  
8 this is the first phase of it.

9 WITNESS BOUCKHOUT: I think,  
10 Mr. Marshall, to be specific, I believe you're  
11 referring to the passage that states on our prepared  
12 evidence, page 8, sensitivity ratings on the alignment  
13 sheets could be useful in planning summer surface  
14 access for such access, for such contingencies as  
15 emergency repairs, is that correct?

16 Q No, I really didn't  
17 have that particularly in mind as arising out of my  
18 discussion with Mr. Drew this morning.

19 A I see, I thought you  
20 were referring directly to his direct evidence. I'm  
21 sorry I was mistaken.

22 Q I was wondering, Mr. Drew  
23 if you had any opportunity to this point to verify the  
24 sensitivity ratings that you have developed in the  
25 field?

26 WITNESS DREW: Yes, I have in  
27 the course of my field studies I have examined these  
28 units. I've taken particular notice of what has  
29 happened where there have been clearings of one type  
30 or another, trespass on, even what happens when I walk



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on the ground, when others walk on it, and I have  
put all this into my field notes and/we go to our  
final terrain typing these will all be taken into  
consideration, estimates will be improved.

Q Do you then go back to  
this particular site, say where you've noticed some  
disturbance to check the sensitivity of the terrain at  
the different seasons? I think Dr. Strang mentions  
there are three seasons, if you like, where the  
sensitivity of terrain is quite different. Do you do  
that so -- I take it that you're at an area on a  
particular occasion and you notice a disturbance and  
you make some notes about it. I was wondering if  
you go back to that same location in the other two  
seasons in order to modify, if necessary, your  
sensitivity ratings of that particular terrain type.

A Well, in the winter it  
would be unnecessary to go back because everything  
is going to be frozen and covered with snow, and I  
wouldn't see anything anyway, and things are stable  
and I've already indicated that almost in all cases  
with a few exceptions that I illustrated that the  
sensitivity is very low in the winter, from a terrain  
point of view. I'm not saying that some vegetation  
can't be damaged by winter trespassing, so the winter  
season is not necessary now that field checks have  
so far been spring and fall field checks, spring  
being better than the fall. But I haven't duplicated  
areas. Now whether that will be in the program in the



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2 future or not, I don't know; but that's not really  
3 necessary because when I see that something has been  
4 eroded and so forth, it's happened over a few years  
5 and I could see that sensitivity and I know enough  
6 about different types of material to know how wetting  
7 is going to affect them. I know wetting is going  
8 to affect the silt or the clay a heck of a lot more  
9 than it's going to affect gravel.

10 Q So if you see it in  
11 the summer months, that tells you what you need to  
12 know?

13 A Yes, it does.

14 Q Now, what about checking  
15 at these sites to see if the terrain has been  
16 sensitive to various types of activity other than  
17 simply the one that in your judgment caused the damage?

18 A I don't understand your  
19 question.

20 Q Well let's say for  
21 example you come across a particular terrain type where  
22 there has been some damage due, in your judgment, to  
23 the activities of a bulldozer equipped with a blade,  
24 and you rate that terrain as having a particular sensi-  
25 tivity on your scale. Do you -- how do you take into  
26 account the possible sensitivity that that same terrain  
27 might have for various other types of activities that  
28 one could envision going on in pipeline construction  
29 for operations and maintenance, such as the use of  
30 soft-track vehicles across the terrain, or the operation



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2 of a chilled pipeline?

3 A Well, I have a limited  
4 number of map units which we've mapped and quite  
5 a large number of field stops and I see maybe in that  
6 once place I see a unit of high terrace or something,  
7 or it's been bladed with a bulldozer, somewhere else  
8 I'll see it whether it's just been hand clearing of  
9 a line, somewhere else I'll walk on it and get an  
10 impression and from the total of all of these I will  
11 get a better impression of the terrain sensitivity.

12 Q Tell me how many classi-  
13 fications you have come up with in your sensitivity  
14 rating . Do you have it on a a 1 to 10 scale?

15 A Oh no, I thought perhaps  
16 you were familiar with our alignment sheets, it's a  
17 1 to 4 scale.

18 Q 1 to 4. How does that  
19 compare with the G.S.C. terrain sensitivity?

20 A In what way?

21 Q The same? Well, is your  
22 rating basically the same as that?

23 A No, it's my own.

24 MR. MARSHALL: I think those  
25 are all the questions that we have for this panel.

26 (WITNESSES ASIDE)  
MR. SCOTT: At this juncture,

27 Mr. Commissioner, could I make one request, and two  
28 observations? The first is a request of Mr. Marshall  
29 -- I understand that Arctic Gas under Mr. Spence-Taylor  
30 had prepared a terrain sensitivity map and report for



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the entire Mackenzie Valley and I'm not certain because I haven't checked, whether that is on their list of produced documents, but if it isn't I'd be grateful to them if Mr. Marshall could provide it to us so we could prepare his work for Arctic Gas with that of Mr. Drew.

The other matter has to do with the panel that will be dealt with next week, the Phase 3 panel. Foothill has in this panel called -- provided rather a larger panel than perhaps is traditional, and specifically they have included an archaeologist and I don't know whether to call Mr. Taylor aesthete or a landscape architect or what, but his discipline is represented.

THE COMMISSIONER: Aesthetist.

MR. SCOTT: Aesthetist. Both those gentlemen raised issues which have been probed and which though one of their disciplines at least is reasonably novel, should be probed further and I understand that Arctic Gas has retained people who have done comparable work for them, Dr. Miller, an archaeologist, and somebody else in the aesthetic area. In the Panel 3 summary their conclusions are provided out of Mr. Hemstock's mouth, and that's very useful. Mr. Hemstock is close to becoming the new Mr. Williams in environmental matters. I just wonder if in the circumstances Arctic Gas could give consideration to either expanding their Phase 3 panel to include such persons as I've described, or alternatively



1 indicating at what other stage they can be made  
2 available.

3 MR. MARSHALL: I think  
4 we got to the position we're in now as a result of  
5 an earlier request from Mr. Scott to see what we  
6 could do to keep the size of the panels down, and  
7 having now had some success in that in that our  
8 forthcoming panel is smaller than the one you  
9 presently have before you, we find the situation is  
10 being reversed. What I propose, Mr. Scott, is that  
11 in those two areas that you put your questions to the  
12 panel and if you find that they are unable to deal  
13 with them to your satisfaction, then we can make  
14 arrangements to call people who have more detailed  
15 knowledge in those areas. If that's --

16 MR. SCOTT: Well, I think the  
17 technique that we developed to keep the panels in  
18 modest size was to sequence the cross-examination  
19 according to disciplines, and that has been reasonably  
20 effective last week and earlier this week, and I hope  
21 will be effective in Phase 3. If archaeology is to  
22 be a matter of concern and Foothills has indicated  
23 that they have certain propositions to make there,  
24 I'm not sure that it's satisfactory to have Arctic  
25 Gas' archaeological evidence come through somebody  
26 else, and I don't make this anything but an observation.  
27 It seems to me it will be wasteful of everybody's time  
28 to ask archaeological questions of Mr. Hemstock to  
29 say nothing of aesthetic questions of him unless  
30 aesthetic matters be regarded as so entirely subjective



1 that Mr. Marshall's own evidence might be as good as  
2 anybody else's. It's simply a request that that matter  
3 be considered, if not for Phase 3, perhaps at the  
4 cross-delta phase or at some subsequent time.

5 THE COMMISSIONER: Well, where  
6 ought this to be left? Might we let Mr. Marshall go  
7 ahead on Monday with his panel on Phase 3, as I under-  
8 stand he has one panel on Phase 3, and let him bring  
9 his people up, the short list, and then if it appears  
10 Monday or Tuesday that it is vital that the archaeolo-  
11 gist come along, probably he can be brought up next  
12 week and we won't have to leave it till Phase 4 or  
13 something like that.

14 MR. SCOTT: Well, I presume  
15 that that would be entirely fine with us, and Mr.  
16 Marshall would undoubtedly have difficulty lining these  
17 people up on short notice so I didn't expect that, but  
18 it was simply that while we're anxious that Mr. Hemstock  
19 should be on all these panels, it no doubt becomes  
20 extremely difficult for him to speak for a number of  
21 disciplines in which he has no training, knowledge,  
22 or experience.

23 MR. MARSHALL: Well, I think  
24 that you may find that's not quite the case. Dr.  
25 Banfield is also going to be on the panel and he has  
26 some background in archaeology as well; but perhaps  
27 if you find that there isn't sufficient depth for the  
28 level of questioning that you would like to get into  
29 we can make the arrangements the Commissioner has  
30 suggested.



1                               Incidentally, I should men-  
2       tion that Dr. Banfield will be on the panel and he  
3       will be giving some evidence. Unfortunately, because  
4       of his absence in Scotland, until recently, we don't  
5       have his evidence prepared yet. He has been busy  
6       working on it while he's here in Yellowknife.

7                               MR. SCOTT: That seems to  
8       be his preferred technique.

9                               THE COMMISSIONER: I think it's  
10      better if it comes as a surprise to all of us.

11                              MR. MARSHALL: Well, it looks  
12      like that is going to be the case, sir. But as soon  
13      as we do have it available we'll see what we can do  
14      to get copies to the participants.

15                              THE COMMISSIONER: Well, Mr.  
16      Scott, all that remains is for you to cross-examine  
17      this panel, but I think we should advise the panel,  
18      if you haven't already, that you were not in a  
19      position to complete your cross-examination of them  
20      today in any event.

21                              MR. SCOTT: That is correct,  
22      sir.

23                              THE COMMISSIONER: That means  
24      that we would have to bring you back next week, sorry  
25      to say, Mr. Bouckhout and other members of the panel,  
26      and so in those circumstances I would be inclined  
27      myself to leave cross-examination of this panel by  
28      Mr. Scott until Monday at one o'clock and as soon as  
29      it is completed, Mr. Marshall can bring forward his  
30      panel on behalf of Arctic Gas.



1 All we would gain this  
2 afternoon by sitting would be about an hour, and that  
3 would not allow us to excuse you, unfortunately. The  
4 reason I think I should say for this, at least this  
5 is a problem you run into, is we have been sitting  
6 so often this week, that is such long hours, that it  
7 has been difficult for Mr. Scott and Dr. Fyles and  
8 their colleagues to put together their complete cross-  
9 examination they had wished to.

10 So unless there's any violent  
11 objection from those who are anxious to come back for  
12 an hour this afternoon, hearing none, I think we will  
13 adjourn until nine o'clock -- excuse me, Monday morning  
14 at one o'clock in the afternoon.

15 MR. SCOTT: Would you like to  
16 try that again, sir? Monday morning at one o'clock  
17 in the afternoon?

18 THE COMMISSIONER: Oh.

19 (PROCEEDINGS ADJOURNED TO NOVEMBER 17, 1975)  
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